

ELECTRICAL CONSTRUCTION AND MAINTENANCE

APRIL • 1950

Electron Tubes

Maintenance of industrial tubes related to cathode types.

Light that Sells

How modern lighting methods are keyed to merchandising problems.

Estimating

How to take-off and list feeder and power circuits.

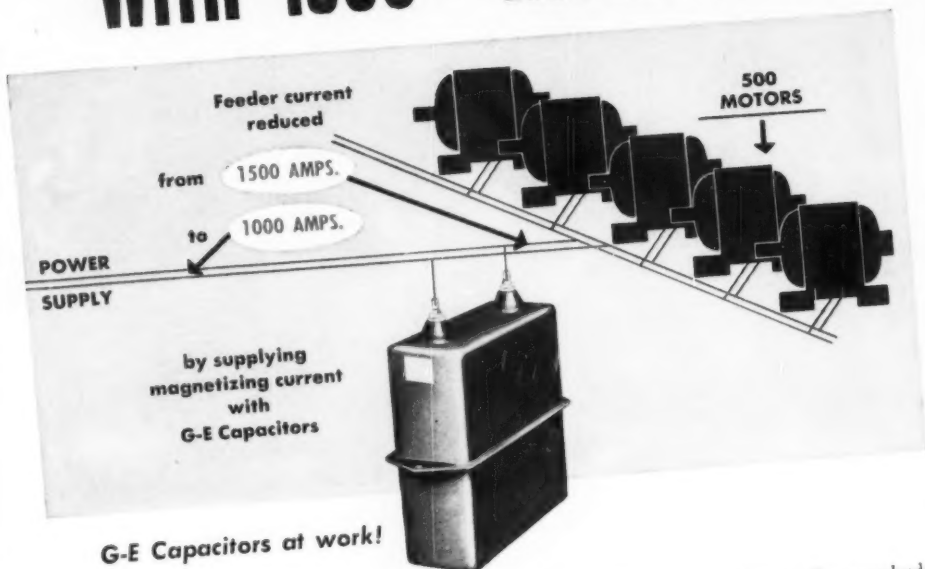
Special Feature

Preventive Maintenance

How to plan and carry out preventive maintenance schedules on electrical equipment.

A
McGRAW-HILL
PUBLICATION

OHIO PLANT CUTS CURRENT $\frac{1}{3}$ WITH \$1300⁰⁰ INVESTMENT



G-E Capacitors at work!

WHEN STANDARD ENVELOPE MANUFACTURING CO. of Cleveland added new equipment, switches overheated and fuses blew. It looked like new wiring was called for. However, investigation showed the culprit to be a low power factor. Total current drawn by 500 motors, many only 1/25 hp, was 500 amperes more than it need be.

G-E CAPACITORS WERE INSTALLED—at a cost of only \$1300. Total current dropped one third, production returned to normal—and the wiring then has capacity to spare for expansion. Also, because power factor is up to 97%, the company's power bill was reduced \$28 a month.

G-E CAPACITORS will almost always relieve overloaded feeders and transformers—and they will usually improve voltage. Where power contracts have a power-factor or kva-demand clause, they may also make possible outright monetary savings. In any event, your electric utility, your contractor, or a G-E specialist can help you determine accurately just what they will save.

Meanwhile, see what others have done with capacitors—ask for our 8-page booklet, GEA-5167. Write Section B407-192, Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—
GENERAL  ELECTRIC
407-192

NEW!

**COMPACT!
ECONOMICAL!**

**Murray
LOAD
CENTERS**

with Fully Magnetic Circuit Breakers

Now you can get all the advantages of fully magnetic circuit breaker protection in load centers that are trim and compact — with breakers that are interchangeable with other new single pole individually housed breakers! Now you can get utmost flexibility with minimum stock — make up your own combination right on the job! Now you can forget about "derating" ... now you can banish the nuisance of false tripping ... now you can make satisfactory installations of circuit breakers in warm or poorly ventilated locations—where space and cost are important!

These compact new Murray load centers are available in 2, 6 or 8 circuit models. They come equipped with the sensational new small size Murray fully magnetic circuit breakers — now 30 per cent smaller than previous fully magnetic circuit breakers — available in ratings of 10 through 50 amp. They save you time ... save you trouble ... save you money — yet assure the user positive protection combined with utmost satisfaction!



**That are Interchangeable
with Other New Single Pole
Individually Housed Breakers**

**Shallower
Box —**

—only 3 inches deep—ideal for flush installation in "dry wall" construction. Plus a simple $\frac{3}{8}$ " plaster line adjustment!



See for yourself why Murray fully magnetic breakers can't trip from heat...never need derating...always carry rated load plus harmless overloads—even in warm locations and poorly ventilated panels. Clear, simple diagrams tell the story in this folder. Write for your copy today.

Murray

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Explosion-Proof Lighting Fixture



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ELECTRICAL CONSTRUCTION AND MAINTENANCE

This journal is known as Electrical Construction and Maintenance, The Electrician and Electrical Record... Established 1887

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

49th Year — APRIL • 1950

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for
your money**

**also...in
midget size**



PLUGIN BUSDUCT


YOUR ELECTRICAL DOLLARS WILL GO MUCH FARTHER with Plugin  Busduct . . . because here's an electrical distribution system designed to economize on everything but efficiency.




By providing convenient plug-in outlets every foot of the way, there's always a ready power source for new or present equipment anywhere along the production line . . . just plug-in wherever you want . . . no slowing down production to make needed changes . . . no expensive wiring delays . . . no high cost electrical maintenance . . . in fact, there's nothing much to do but *plug-in and let 'er roll*.

Add up these and many more cost-cutting features of Plugin  Busduct . . . and you'll agree that here is the electrical distribution system that makes ends meet in more ways than one.



 **POWER PLUGIN**, the new midget-size Plugin  Busduct of 50-amp. feeder capacity, is now available for equipment requiring connections for $\frac{1}{2}$ to 3 HP motors, 240 volts or less, AC or DC ($7\frac{1}{2}$ HP maximum, with dual-element fuses).

Featuring all the convenience, flexibility and economy of Plugin  Busduct, this new Underwriter Laboratories approved duct is made in 5-ft. and 10-ft. sections with plug-in outlets every 20 inches . . . additional outlets and special lengths available on special order.

For more information about Plugin  Busduct and  Power Plug-in, write for Bulletins 701 and 703 . . . or talk to your  Representative (he's listed in Sweet's).



Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

HIGHER

CURRENT VOLTAGE HORSEPOWER



ALLIS-CHALMERS TYPE H STARTERS

FOR 2300 to 5000
VOLT MOTORS

VOLTAGE	RATED AMPERES	H.P.	STARTER WIDTH
2300	400*	1000*	34"
up to 5000	and 200*	1500*	

*Air-Break Contactor top rating limited by short circuit fuses.

COMPLETE CONTROL PLUS PROTECTION for your motors in an attractive steel cabinet that is compact and easy to install . . . that's the Allis-Chalmers Type H Starter for motors to 1500 horsepower at 5000 volts.

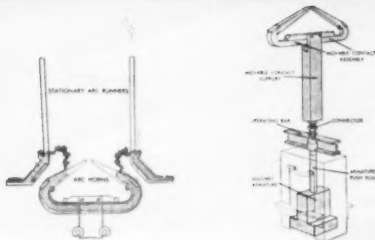
When equipped with air-break contactors these compact starters are 34" wide for full voltage . . . only 38" wide for reduced voltage applications.

You can get Type H Starters for squirrel-cage, synchronous and wound rotor motors — for full or reduced voltage starting . . . for reversing or dynamic braking. For a single starter or an entire control group, check with Allis-Chalmers. Call your nearby A-C representative or send for bulletins 14B6410 and 14B7303.

A-2978

ALLIS-CHALMERS, 930A SO. 70 ST.

MILWAUKEE, WIS.



DOUBLE BREAK CONTACTS AND STRAIGHT LINE VERTICAL ACTION are combined in Allis-Chalmers Air-Break Contactors to eliminate maintenance factors like flexible contact leads, turning shafts and shaft bearings. These contactors are clean and easy to inspect and maintain . . . accessible in compact attractive Type H Starters.



COMPACT, RIGID CONSTRUCTION PLUS NEAT APPEARANCE...

Enclosure of heavy gauge steel is welded for rigidity and strength. Heavy parts are supported by framework of steel channels and angles. Full width steel barrier separates low and high voltage compartments. All components are easily accessible behind hinged doors.

ALLIS-CHALMERS



ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1950

It's easier to work *the Inch-Marked way*



With Inch-Marked,* threadless ELECTRUNITE E.M.T., there's no danger of losing expensive thread-cutting tools on the job. Simple, one-piece ELECTRUNITE Benders, end wrenches or pliers, and a back saw are all that's needed by an experienced electrician to put in a strong, rain- and concrete-tight ELECTRUNITE raceway installation.

with **ELECTRUNITE** **E. M. T.**

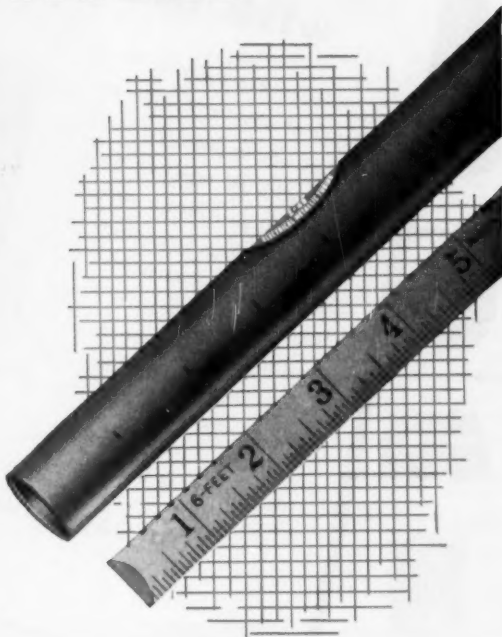
Here's a proved installation advantage found *only* on Republic **ELECTRUNITE E. M. T.**—the *original* lightweight rigid steel raceway for modern wiring jobs. It's Inch-Marking—on every length of **ELECTRUNITE E. M. T.** in $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1" sizes.

With Inch-Marked* **ELECTRUNITE E. M. T.**, workmen can measure bending and cutting distances in an instant without the need for a rule or tape.

Yet, Inch-Marking is but one of many advantages which make jobs go in easier and smoother with modern **ELECTRUNITE E. M. T.** Uniformly high ductility, knurled inside surface, light weight and freedom from tedious thread-cutting all combine to make **ELECTRUNITE E. M. T.** the outstanding buy in the raceway field.

To get the *complete* story about this modern code-approved material, see your nearest **ELECTRUNITE** Distributor, or write today to:

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Export Department: Chrysler Building, New York 17, N. Y.
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"As accurate and easy to read as a folding rule," say workmen who have used and now insist upon Inch-Marked* Republic **ELECTRUNITE E. M. T.**—the raceway that was designed with the electrician in mind.



Republic
ELECTRUNITE E. M. T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1950

7

Another Star for the Complete RACO Line

**They're really anchored
with the RACO S.B.S.!***

Here's a Switch Box Support* that will hold *any* switch box in place. It can be used with all types of wall-board. It provides a strong, firm mounting. Switches (and particularly receptacles) will stay put. No loose parts to get lost in the walls, either. This is another example of the Raco design engineering and construction that keep Raco at the top of the list.



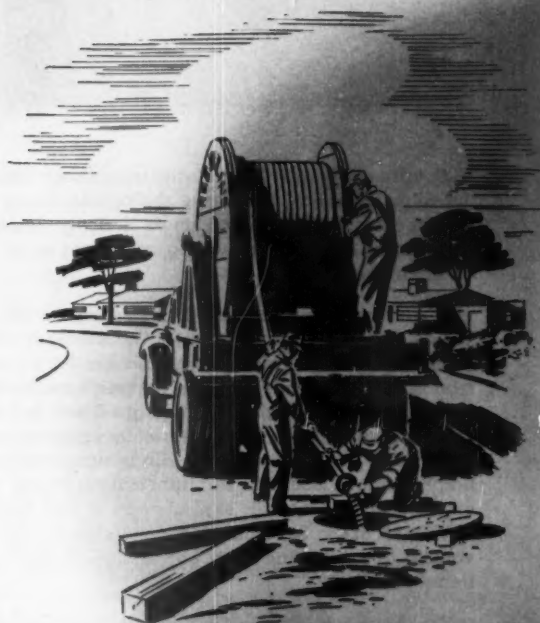
You can always rely on RACO

RACO

ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

"A BOX FOR EVERY NEED"

Today it's Roebling!



Unsurpassed service at lowest cost with Roebling Paper Insulated Cable

YOU NEVER WANTED ECONOMY MORE than you do today . . . and you'll get it by putting circuits underground with Roebling Paper Insulated Lead Encased Cables! No more unsightly overhead lines with their expensive upkeep . . . trouble-free service, uninterrupted and dependable, is yours for years on end.

Roebling Shielded Type H is outstanding for 3-phase grounded neutral circuits from 13 to 33kv. It is available in single and multiple conductor construction, in regular and Compact strand (round or sector). Conductors are shielded with metallized paper, individually insulated, protected with perforated copper shielding tape, and the whole assembly served with a bronze binder tape and lead sheathed. Similar assemblies can be made to your special specifications.

Your nearest Roebling office and sales engineer will be glad to help you select the *right* cable for top performance and economy. John A. Roebling's Sons Company, Trenton 2, New Jersey.



There's a Roebling electrical wire or cable for practically every transmission, distribution and service requirement. All of them are made completely in Roebling plants where the most modern techniques and precision machines assure products of the very highest quality.

ROEBLING

A CENTURY OF CONFIDENCE

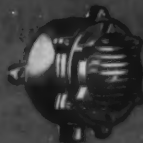
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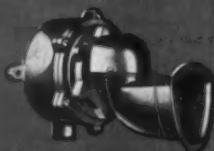
Protect the plant and with **CROUSE-HINDS**

.....bells, horns, sirens, and visual signals

**Raintight signals
for non-hazardous
locations**



Type WH Raintight Horn
with Grill



Type WH Raintight Horn
with Single Projector



Type WH Raintight Horn
with Double Projector



Type FB Raintight
Pilot Light Conduit

A
Nationwide
Distribution
Through Electrical
Wholesalers



The most complete line

Continuous production is of vital importance in successful plant operation. Costly shutdowns can often be avoided by Crouse-Hinds signals that give an instant warning of abnormal operating conditions or sound an alarm in case of fire.

A wide variety of signals is necessary to meet the varied conditions in industry. Crouse-Hinds offers a comprehensive line of signaling devices for plant protection and communication . . . sirens, horn, bells, and visual signals. Each unit is designed with individual characteristics that make it superior for a particular kind of service. There are Crouse-Hinds signals for use in non-hazardous locations; raintight signals for use where exposed to the weather; explosion-proof and dust-tight signals for use in hazardous locations; signals with a low volume of sound and high power signals that are extremely loud.

You have a definite advantage in selecting signals from the all-inclusive Crouse-Hinds line. It is possible for you to meet the requirements of every location. In noisy areas the character of the noise is of first importance. A signal producing a sound having the greatest contrast to the area noise should always be selected. For example, a horn would not be suitable in

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Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas
Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles
Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — Portland, Ore.
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CONDULETS • TRAFFIC SIGNALS • AIRPORT LIGHTING • FLOODLIGHTS

maintain continuous production **Signaling Devices**

for control of operations, and fire protection.

**of explosion-proof and dust-tight
signals for hazardous locations**

surroundings where a constant hum or whine is present but a bell could readily be heard. A bell would be inadequate in surroundings where the noise is produced by hammering on metal but a horn would give the required contrast.

Careful consideration should also be given to the number of signals required. In general, much better coverage is obtained by even distribution of several low output units than by one or two high output units. On the other hand, a high powered unit is necessary when the sound must be projected a considerable distance from one location.

Crouse-Hinds' line of visual signals includes a variety of pilot lights and also the Visularm, a compact unit used to supervise manufacturing processes. The Visularm will automatically indicate normal and abnormal temperature, liquid level, speed, load, or any other condition which can be electrically coupled to the circuit. An independent circuit is provided in the Visularm to actuate an audible signal.

In Crouse-Hinds' complete line there are dozens of different units from which to choose the items to meet your particular requirements. They are all listed in the Crouse-Hinds Condulet Catalog.



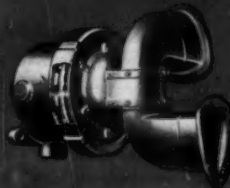
Type ETH Explosion-Proof
Resonating Horn



Type ETH Explosion-Proof
Standard Volume Horn



Type ETH Explosion-Proof
High Power Horn
with Grill



Type ETH Explosion-Proof
High Power Horn
with Double Projector



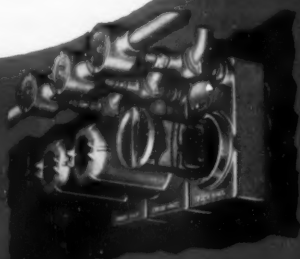
Type ETH
Explosion-Proof
Siren



Type EGP Explosion-Proof
Panel-Mounting Switch and
Pilot Light Condulet



Type EFD
Explosion-Proof
Pilot Light Condulet



Three Type EKP Explosion-Proof
Visularms. One cover removed.
Clear view of panel.

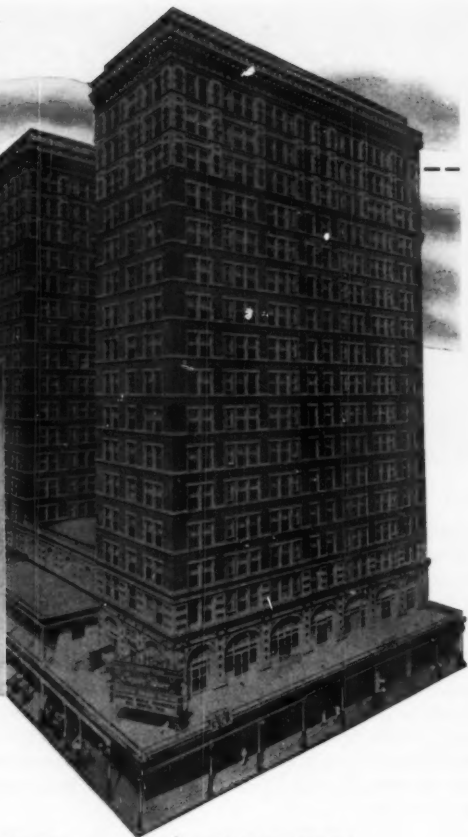


Type EBR
Explosion-Proof
Bell

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



*Rice Hotel, Houston, Texas
Architect: Kenneth Franzheim, Houston
Mechanical Engineer: Reg. F. Taylor, Houston
Electrical Contractor: Fischbach & Moore of Texas,
Inc., Houston
Load: 3,000 kva for power and lighting to serve 1,000
guest rooms, ballrooms, banquet rooms, dining rooms*



Rice Hotel *REMODELS and SAVES* **with Low Impedance Bus Duct**

While the basic advantage of using bus duct is to secure more adequate secondary power distribution, the choice of bus duct should not stop there.

Take the case of the installation limitations at the Rice Hotel, Houston. The problem: to completely remodel and air condition from basement to penthouse—and without interruption of "business as usual".

The answer: Westinghouse Low Impedance Bus Duct. Its compact design and freedom from protruding members permitted passage in places where dimensions were critical. Limited space, because of pipe and air duct systems, ruled out

ordinary wiring, as well as other makes of bus duct.

Ask your nearby Westinghouse representative to tell you all the advantages of Westinghouse Bus Duct, available in four popular types. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30012



BUS DUCT





Rolling Again in 36 Hours

THANKS TO ALLIS-CHALMERS CERTIFIED SERVICE!

A vital press of the Detroit News went out of commission when a 5 hp inching motor, overspeeded at 20,000 rpm, flew apart. Stecker Electric, an A-C Certified Service Shop, was called. Broken end bells had to be welded and machined to fit. The stator was rewound. Rotor windings were replaced. After completely testing the motor, it was back in service in just 36 hours!

IN DETROIT, and over 75 other cities covering all major industrial areas, you will find Allis-Chalmers Certified Service Shops. Make them your source for fast, reliable electrical repair service! Independently owned and operated,

these shops have been selected for their experience, highly skilled workmen, complete servicing facilities, and sound business reputation.

To save time, trouble and money on emergency or routine maintenance service call on your nearest Allis-Chalmers Certified Service Shop.

GOOD SOURCE FOR NEW MOTORS, TOO
Remember — your local Allis-Chalmers Certified Service Shop or Authorized Dealer offers the same fast, dependable delivery on new motors—plus matching control from one to 200 hp. For service or new equipment, count on Allis-Chalmers.

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1950

Sold . . .

Applied . . .

Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

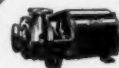


CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types from 1/2 in. to 72 in. discharge and up.



DEPENDABLE *Protection*

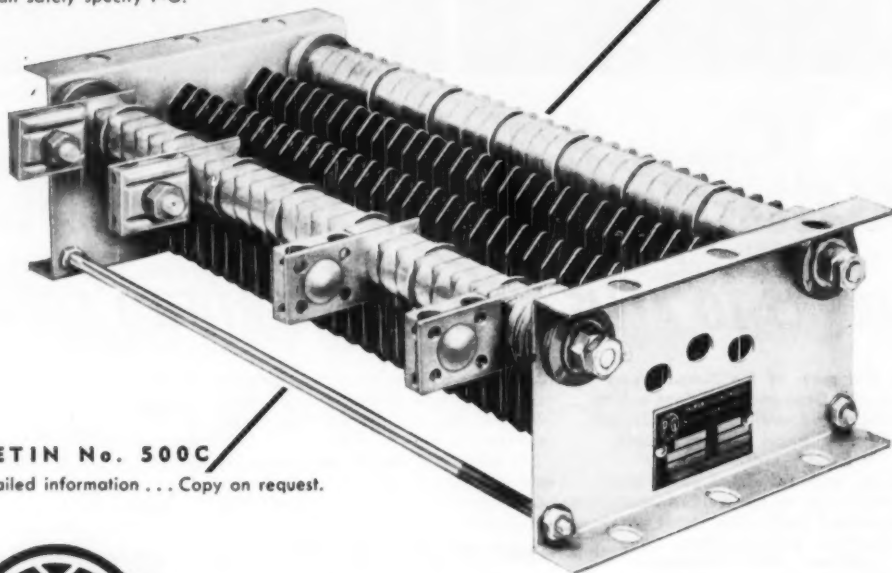
with **P-G** *Steel Grid Resistors*

Steel and Mica, with P-G design, create a resistor really able to protect electrical equipment, especially, where service requirements are severe.

P-G Steel Grid Resistors are sturdy, light in weight, and consistently dependable.

These resistors maintain unusually constant resistance values regardless of temperature or age.

Where "trouble-free" resistor service is essential . . . you can safely specify P-G.



BULLETIN No. 500C

Gives detailed information . . . Copy on request.



The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

SWEEPING THE COUNTRY

A completely new method of
dust removal for masonry drills!

The New Carboloy "LIVE-SPIRAL" Masonry Drill

... is setting amazing sales and
performance records everywhere

"IT'S A SENSATION—we can't keep up with the demand!" That's the report from all over the country about the astounding, new Carboloy "Live-Spiral" Masonry Drill.

Once you've seen this "Live-Spiral" Drill in action, you'll say "wrap it up". And here's why:

A new principle *lifts out the dust*—permits continuous drilling—faster, easier, cleaner, deeper. The secret—a unique spiral wire, permanently attached at both ends of the drill, cleans the hole as it is drilled at any depth.

There is no packing of dust, no lifting out of the drill for a new start—the "Live-Spiral" Drill goes all the way without stalling. The cutting tip of Carboloy Cemented Carbide—the hardest metal made by man—bites into any masonry, the tougher the better.

NOW—LOOK AT THIS! This revolutionary drill, neatly packaged in a transparent plastic tube, is yours at no increase in price!

Get the full story on this drill. Fill out the attached coupon; send it in today.

CARBOLOY COMPANY, INC.

11175 E. 8 Mile Street, Detroit 32, Michigan

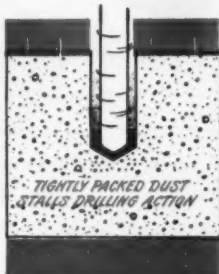
"Carboloy" and "Live-Spiral" are trademarks of Carboloy Company, Inc.

CARBOLOY

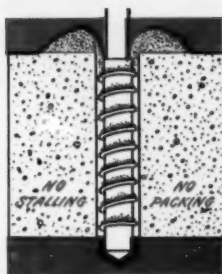
CEMENTED CARBIDE

"Live-Spiral" Masonry Drills

—the most
revolutionary
masonry drill
ever designed!



Ordinary carbide masonry drills will drill to depth about 3 diameters of tip before loading up with tightly packed dust that stalls drilling action.



New Carboloy "Live-Spiral" Drill with Carboloy tip goes all the way without packing, cleans dust from hole, drills continuously... faster, easier, cleaner, deeper.

MAIL THIS COUPON TODAY!

Carboloy Company, Inc.
11175 E. 8 Mile Street, Detroit 32, Michigan

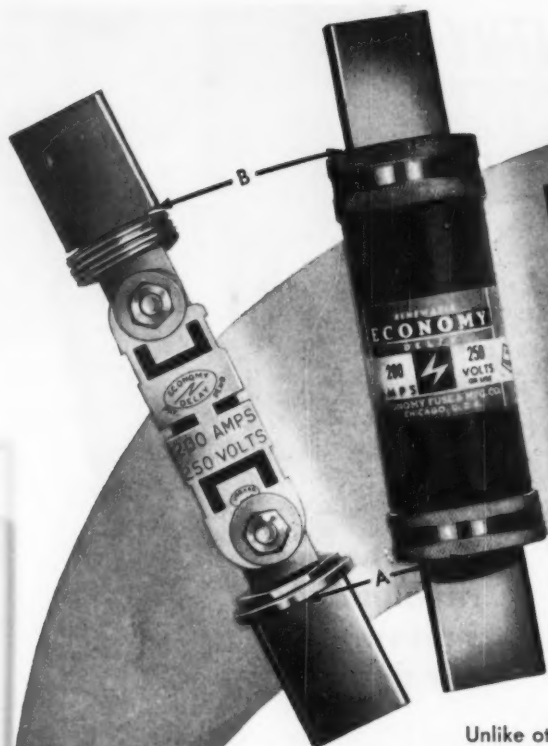
Please rush me complete information and prices on your revolutionary, new Carboloy "Live-Spiral" Masonry Drill.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____



Economy KNIFE BLADES keep *Perfect Alignment*

Due to exclusive design and construction (Patent applied for), accurate alignment of knife blades is maintained automatically in the new Economy "DE-LAY" Renewable Fuses.*

Unlike other Fuses, the Economy knife-blade assembly seats only at the lower end (A) which enters the cartridge tube last.

The upper end (B) is a threaded plug member which acts like a Float—compensating for any dimensional changes and preventing any pressure developing on the knife blades—thus eliminating the chief cause of knife-blade misalignment.

That is why Knife Blades in Economy
"DE-LAY" Fuses are in perfect alignment.

Specify Economy "DE-LAY" Fuses to eliminate the major cause of poor contact, and insure long life to the fuse cartridge.

Your Electrical Wholesaler has the new Economy
"DE-LAY" Fuses and Renewal Links in Stock.

*Give maximum protection in the 135 to 200% overload ranges where most "blows" occur.

ECONOMY

DE-LAY

RENEWABLE CARTRIDGE FUSES

You are invited to write for the New Economy Catalog

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

**CALL YOUR
CENTRAL CONDUIT
DISTRIBUTOR
WHEN YOU NEED...**



a HELPING HAND

You'll find that your Central Conduit Distributor is always ready to give you a helping hand. He's built an organization that has a reputation for service and he's determined to keep it that way.

You'll find, too, that your Central Conduit Distributor offers a wide selection of fine products. Take Central Conduit, for example. There are three types to choose from . . . Cenlaco, Central White and Central Black. Each type measures up to the high standards that have made the name Spang famous for quality.

Whenever you need a helping hand, call your Central Conduit Distributor. You'll like all the products he has for sale and his way of doing business.

SPANG-CHALFANT

Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities



CENLACO (HOT DIPPED)

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

Another
Slimline Beauty

joins the
parade of
smart-looking

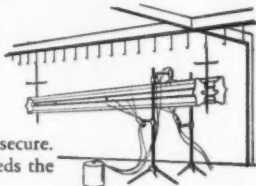
Litecontrol Fixtures



Smart in Appearance! Flowing of line and graceful, this new slimline fixture by Litecontrol is ideal for good-looking installations in store, office, library, showroom or school. And so flexible... in lengths, in mounting... that it easily fits any room or ceiling height.

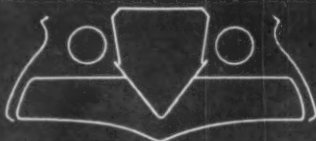
One Man Relamping! Because it's designed for easier maintenance, cleaning and relamping can be done from the top. However, when required, baffle assembly is easily released by means of the self-retaining catches. Whichever way seems best, one man can do the job.

Built to Last! Like all Litecontrol fixtures, this new slimline unit has all those features that spell longer life. It's made of electroplated, zinc-coated steel, Bonderized for paint adherence and rust protection. And it's finished with an electrostatically-sprayed and baked coat that means unusually high light reflectance.



Easy to Install! Just locate fixture body against stem or bracket weld bolt and secure. Wire, lamp, and slip baffle assembly into place. Simple, two-piece construction speeds the entire assembly job.

Efficient Design! Efficiency is excellent, for lamps are optically positioned with respect to high-reflectance, wide-radius side rails. Baffles offer minimum resistance to light passage yet ensure that desirable 35°-25° cut-off.



Available for 2'-8" slimline lamps (26628), 2'-4" slimline lamps (26624), and for 2'-4" Bipin lamps (26624). Use long pendants or short—single or double—or the special closeup ceiling bracket.



LITECONTROL
Fixtures

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant St., Watertown 72, Mass.
DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING
EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALEERS

MAKING A TOUGH CABLE

Tougher!

Stripping off
the lead sheath
after a Tirez Cable
has been
"Cured-In-Lead"

...That's what the "Cured-In-Lead" process is doing for every TIREX portable cable — adding extra wearability to their Selenium Neoprene Armor to assure long, trouble-free service under the most severe operating conditions.

HERE'S HOW IT'S DONE

Before jacket vulcanization the cable is run through a lead press which forms a lead "pipe" snugly around the jacket. During vulcanization this pipe firmly holds the cable, preventing any distortion of the jacket while it is still soft and pliable and assuring maximum density. When vulcanization is completed the lead is stripped off leaving an extra-tough jacket that needs no additional protection.

HERE'S WHAT IT DOES

It produces a jacket that is unexcelled for effective resistance to abrasion and rough handling... provides it with a smooth outer surface which slides easily around obstructions without cutting or tearing... maintains uniform diameter, assuring easy and compact reeling or coiling... furnishes the means for positive identification of the size, type, number of conductors, and operating voltage of each cable as markings inside the lead pipe can be transferred to the jacket during vulcanization.

All TIREX Cables, and TIREX Cords too, are cured in lead. They are made in sizes and types to meet the requirements of all portable electric equipment. For a complete description of the "plus values" they provide, write us today for Folder 993.

SIMPLEX-TIREX

SIMPLEX WIRE & CABLE CO.

79 Sidney Street
Cambridge 39, Mass.





WEATHER FORECAST ...

SALES FORECAST ...

fair and warmer
(ANY TIME NOW!)

*Get set now...for
cooling season sales*



MAKE EXTRA PROFIT WITH SANGAMO TIMERS

**ideal for attic, window, and
ventilating fan control!**

Here's a "natural" for cooling season sales... tie in a Sangamo Interval Timer with every attic, window, or ventilating fan installation you make. Sell your customers freedom from the bother of turning units off manually—from the needless expense of letting units run all night—sell them the economical convenience of automatic control!

Easy-to-sell Sangamo Timers are designed and built by experts in automatic time control... are fully guaranteed... and they're priced right, too!

Catalog No. 1010A gives full information.



Small in Size... but BIG in Quality

Sangamo Interval Timers offer high accuracy at low cost. They provide an automatic OFF operation following an elapsed ON interval which is manually preset for each operation. The unusually quiet, low-speed motor operates only after the manual setting has been

made. The operating range covers any period from 15 minutes to 12 hours.

The Type-T Timer, for wired-in construction, may be either wall or switch box mounted, and is rated at 15 amperes A.C.

Type TJ Portable Timer

Sangamo also offers a portable timer with a 6-foot plug-in cord and built-in receptacle for portable convenience. Type TJ is rated 10 amperes or $\frac{1}{4}$ HP at 120 volts.



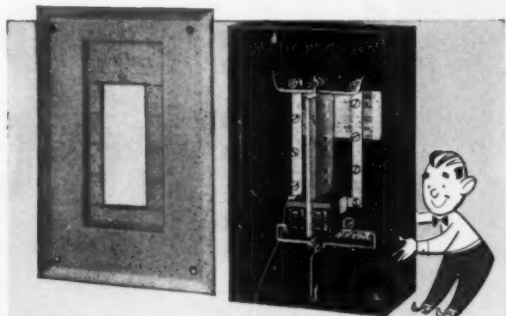
SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



When fast delivery of Panelboards counts

nail down the job with *Pushmatic*® Electri-Centers

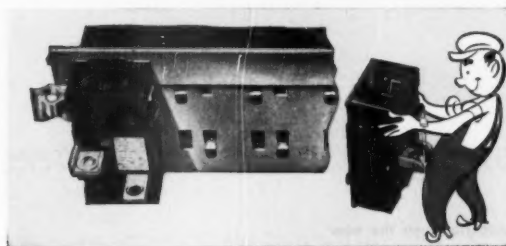
Get the jump on every job by stocking minimum supplies of flexible Pushmatic Electri-Centers



1 By stocking a small supply of basic Electri-Centers and fronts plus . . .



2 several boxes of flexible, interchangeable Pushmatics, supplied from your local Distributor, you can make immediate delivery.



3 When you have a rush job, simply pick out the correct basic Electri-Center and hook Pushmatics of the desired ratings and types on the mounting rib and connect them to bus bars with a screw driver.

There's a Pushmatic to meet every load condition: THERMAL ONLY, THERMAL-MAGNETIC, and THERMAL-MAGNETIC with exclusive AMBIENT COMPENSATING FEATURES. All are identical in size and contour, in ratings of 15, 20, 30, 40 and 50 amperes, 1 pole, 120 V., or 2 poles, 120-240 V., AC. All are interchangeable for rating and type.

See your local Bulldog Distributor today. He'll be glad to show you how a minimum supply of Pushmatic Electri-Centers will meet every specification and give you the jump on every job.

BULLDOG ELECTRIC PRODUCTS COMPANY
DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO



4 Your Electri-Center is ready for installation! No time wasted tracking down supplies! When time counts—you're prepared for any Panelboard job with a small supply of flexible Pushmatic Electri-Centers!

PUSH—It's ON!
PUSH—It's OFF!
PUSH—It's ON again!

Push-button switch with automatic protection for electric circuits



BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

now ALL GUTH for 4-foot

+ LIGHT AT THE FLICK OF THE SWITCH

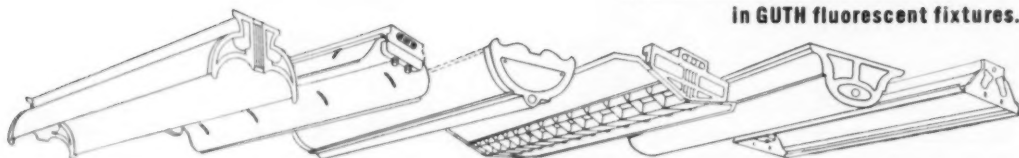
+ NO STARTERS

Here's the biggest fluorescent news in years: you can now use the new 4-ft., 425 ma. T-12 Slimline Lamps in every fixture of the entire GUTH fluorescent line. And the 4-ft. Slimline is efficient! Same lumen output per foot as the 8-ft. Slimline.

Now you have your choice:

- the 4-ft. Slimline
- the 8-ft. Slimline
- standard 40-W lamps
- standard 85-W lamps

in GUTH fluorescent fixtures.



FUTURLITER*

MAZELITE*

CADET*

ARISTOLITE*

FLU-O-INDIRECT*

TROFFERS

FIXTURES

SLIMLINE LAMPS



+ EASY TO HANDLE

For full details,
call your nearest GUTH resident engineer or write

YOUR TEAMMATE
IN
precision-planned
LIGHTING

Guth

LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting Since 1902



TRUCOLITE •

READ WHAT USERS SAY ABOUT

G.E.'s New All-Purpose* Insulating Varnish **G-E 9574**

J. L. Hughes, owner of the J. L. Hughes Electric Company, Columbus, Ohio, says:

"We have found from test and practical experience that General Electric general-purpose varnish 9574 is tops for our work."



J. Lindborg, owner of AAA Electric Motor Service, Atlanta, Ga., says:

"Our experience has been that this varnish is as good as G.E. claims. It gives a good coat on every type of wire, bakes easily and dries to a tough coating that stands up perfectly in service."



Guy W. Probst, owner of Lockhaven Electric Repair Co., Lockhaven, Pa., says:

"I find that I only use about half as much 1201 Glyptal as a cover coat on 9574 as I had to use over the varnish I had been using, and I get higher gloss and better bonding."



These statements indicate the success of the new G-E 9574. If you are looking for an insulating varnish which bakes at low temperatures, penetrates deep coils easily, and requires no special thinner, investigate G-E 9574.

*G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G.E.'s complete line of electrical insulating materials, including wedges, adhesives, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permafils, tapes, tubing, varnished cloths, and varnishes.

Here's A Bulletin You Should Have! If you haven't yet tried G-E 9574 get in touch with your local G-E Distributor, or write for our new bulletin to Section K3, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

You, too, can put your confidence in

GENERAL  ELECTRIC



Cutler-Hammer Type NMO BREAKER PANELS

TRADE MARK

with the "Plug-in" MULTI-BREAKERS



You make up the panel
On the job - For the job

1. Select Multi-Breaker units required by job.

2. Assemble units to panel by "plugging in".



3. Wire them.



4. Plug them in place again.

NO matter what the job calls for when you get there, you are all set when you have a Cutler-Hammer Type NMO Breakerpanel. No matter what circuit load changes may be required if you are called back later on, you are ready if you have installed a Cutler-Hammer Type NMO Breakerpanel. For you make up these distribution centers with the Multi-Breaker Plug-Ins right on the job for the job. No guesswork. No mistakes. The Multi-Breaker units you select to serve your circuits just plug into place. Where you want a 15 ampere breaker, you plug in a unit containing the exact number of 15 ampere single pole breakers required up to four. These four pole units are available in 17 different circuit combinations making it possible to

obtain the exact quantity and rating of branch circuits with a minimum of effort.

Wiring these Type NMO Multi-Breaker units is also a cinch. You can wire them right in your hands before you plug them in... or you can simply swing them out for wiring as shown, using one of the positive-pressure contact jaws turning on the silvered bus bar as a hinge. And despite the small size of these Breakerpanels that better utilize wall and column space, you get much more gutter space ($5\frac{1}{2}$ " in the 15" box) with more circuits. The narrow column type actually has double the number of circuits previously available in cabinets of similar height.

Cutler-Hammer Type NMO "Plug-In" Breakerpanels are now offered in sizes with from 8 to 42 single pole branch circuits in increments of 2. They are available in 120/240 Volts a.c., with 50, 100 and 200 ampere mains (lugs or circuit breaker) with 15, 20 and 30 ampere single and double-pole branch circuits; also, 40 and 50 ampere double-pole branch circuits each of which however, occupies the same space as four single pole 15 ampere breakers. Multi-Breaker units are of the thermal-magnetic type that provide a lag on harmless over-

loads but instant trip on shorts.

Beyond any doubt, this is the finest protection, the easiest to install, the most flexible, the most compact, and the most modern it is possible to obtain where a large number of branch circuits must be served, as in commercial and industrial buildings, hotels, schools, hospitals, large homes, etc. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.



SPOT YOUR POWER

GET MORE PRODUCTION out of every dollar you spend on electric power . . . put dry-type transformers at load centers. Here's what happens: (1) Shorter secondary runs reduce lost power in the line. (2) Better regulation improves output. For example, a 10% correction in voltage gives you 30% more illumination, 20% more motor torque, 22% higher thermal efficiency!

EASY MOUNTING RIGHT AT LOAD GIVES YOU MAXIMUM SAVINGS!

And the closer you locate these transformers to the load the greater your savings will be. That's why the flexibility of locating Allis-Chalmers "dry-types" is an important advantage. You spot them right at the load center. No fireproof vaults needed.

Transformers stocked country-wide in popular ratings. Get bulletin 61B6382A from your A-C sales office. A-3024

**ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.**



ON WALLS, RIGHT NEXT TO LOAD! Hookup is easy with roomy terminal compartments, accessible through removable front and bottom plates on 10 kva and below single phase, and 25 kva and below 3 phase. On 15 and 25 kva single phase, connections made by removing top cover.



**ALLIS-CHALMERS
Dry-Type
TRANSFORMERS**



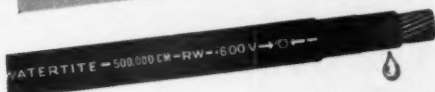
RIGHT ON THE EQUIPMENT IT SERVES! . . . on machines, presses, electric ovens, electronic heaters, etc. Relocation of equipment or shifting loads is no problem — versatile Allis-Chalmers "dry-types" are easily relocated to follow the load.

ON POSTS OR PLATFORMS! You make connections *fast* with solderless clamp connectors on units 15 kva and up single phase, 37½ kva and up 3-phase. Terminals immediately accessible by removal of clamped top cover.

ALLIS-CHALMERS



MAIN PROBLEM MOISTURE?

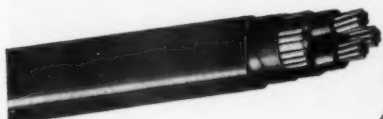


SOLVE IT WITH

HAZARD WATERTITE!

Hazard Watertite offers you a long-lived insulation with high dielectric strength that's effectively impervious to moisture. It's tough, elastic and free stripping. In wet locations, Hazard Watertite speeds and simplifies installation as no protective lead sheath with costly, time-consuming joints and terminals is needed. Since its earliest development as Submarine insulation for non-metallic sheathed underground cables, Watertite has a history of over 20 years in trouble-free service. Approved under NEC as Type RW for use in wet locations without metallic sheath, or Type RH for use at a maximum conductor temperature of 75C.

MAIN PROBLEM HIGH VOLTAGES?

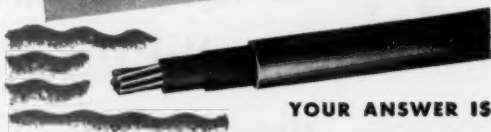


BE SAFE WITH

HAZARD KEYSTONE!

Hazard Keystone, field-proved over the past 50 years, is an oil-base insulation for high-voltage installation. It combines in one compound — resistance to ozone, corona, moisture, heat, sunlight, mildew, acids and chemicals. Your assurance of long, trouble-free service from aerial, underground or interior cable installations with Hazard Keystone insulation is backed by its long, successful service record as well as thorough factory testing which includes both a-c and d-c tests for service over 5000 volts.

MAIN PROBLEM HEAT?



YOUR ANSWER IS

HAZARD PERFORMITE!

Specially developed to withstand the deteriorating effects of heat on insulation, Hazard Performite gives you an ideal answer to this difficult installation problem. Since 1931, this Hazard insulation has been used extensively for all kinds of general interior circuits, branch feeders, portable cables, municipal cables and other special installations demanding long, trouble-free service life and exceptional heat resistance. Performite is long-aging, non-corrosive, free-stripping, mechanically and electrically stable. Approved under NEC as Type RH for use at a maximum conductor temperature of 75C.

THE **RIGHT**
WIRE OR CABLE
FOR ANY JOB
STARTS WITH THE
RIGHT
INSULATION...

There's a Preferred Hazard Insulation for Every Job

For full information about Hazard Watertite insulation write for Bulletin H-422; H-403A gives all the facts about Keystone and H-431 about Performite or ask your Hazard representative. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

8045



Steel City Electric Company Offers You . . .



Not Merely a  Switch Box

Not Merely an  Outlet Box

Not Merely a few    Covers

Not Merely an easy to make  Fitting

But

A COMPLETE LINE

of

BOXES, COVERS and FITTINGS

that meet
Every wiring requirement

And . . .

Every item is backed by a reputable concern with almost 50 years of manufacturing experience.

That is Why **STEEL CITY LEADS IN MEETING CONTRACTORS' NEEDS**

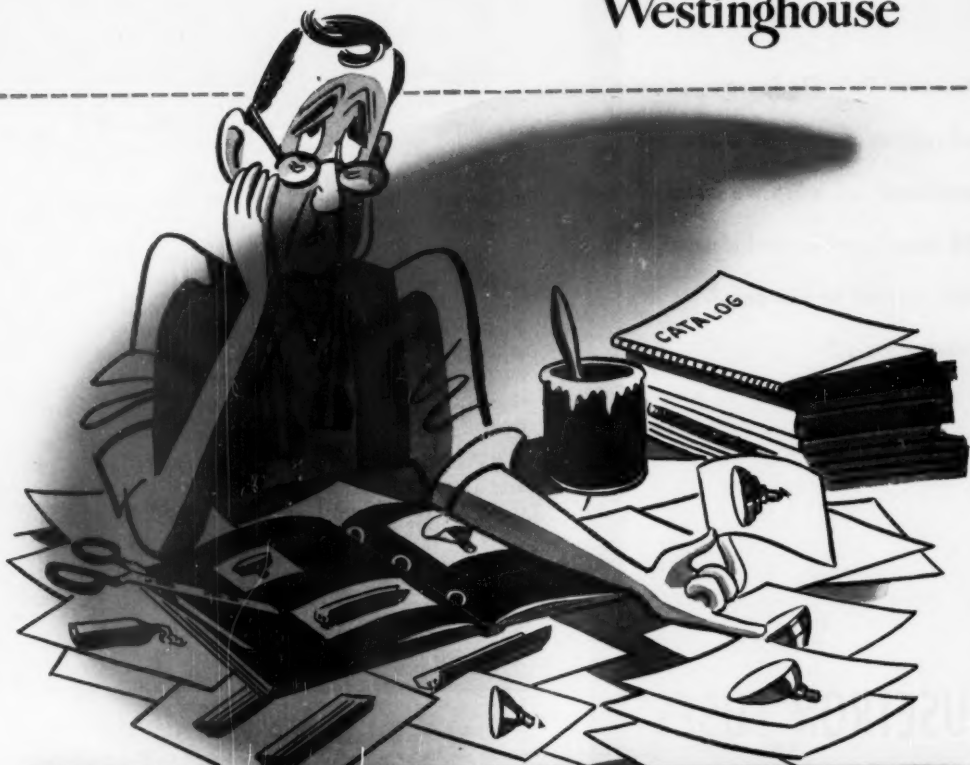
STEEL CITY ELECTRIC COMPANY

1207 COLUMBUS AVENUE,



PITTSBURGH (12), PENNA.

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



Don't be a **FIXTURE PICKER!**

This "character" looks worried. He's picking lighting fixtures. But he won't find the answer in a magazine cutout.

What's more, there is no single "cure-all" lighting fixture. You know that, of course, but how many others do? Each luminaire has a different purpose—a different application—and a different economy depending on specific conditions.

Analyzing these conditions takes an expert. You need the services of a lighting engineer.

Whether you plan lighting, buy lighting, or install lighting, the services of a Westinghouse Lighting Engineer are available to you. J-04281



Westinghouse
PLANNED
LIGHTING
PAYS

**"We Saved Valuable Space . . .
and reduced the cost of a new
panelboard . . . when we installed
400 amp. Fusetron dual-element
Fuses instead of 600 amp.
ordinary fuses."**

FUSETRON FUSES GIVE 10 POINT PROTECTION



"After we were awarded the contract for electrical work in a new ice plant, we discovered that the power distribution panel was far too large for the space allotted to it. This panel was to accommodate two 60 horsepower motors, plus several smaller ones.

"There was only one convenient location, so we refigured the panel size based on using Fusetron Dual-Element Fuses. We reduced the panel sections for the 60 H.P. motors from 600 amp. fuses to 400 amp. Fusetron fuses and reduced the sizes for the other motors in proportion.

"The panel fitted the space easily. In addition to saving the necessary space, the cost of the panel was reduced considerably."

E. H. Brown, Vice President
Sanborn Electric Company
Indianapolis, Indiana

- 1** Protect against short-circuits.
- 2** Protect against needless blows caused by harmless overloads.
- 3** Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
- 4** Provide thermal protection — for panels and switches against damage from heating due to poor contact.
- 5** Protect motors against burnout from overloading.
- 6** Protect motors against burnout due to single phasing.
- 7** Give DOUBLE burnout protection to large motors — without extra cost.
- 8** Make protection of small motors simple and inexpensive.
- 9** Protect against waste of space and money — permit use of proper size switches and panels.
- 10** Protect coils, transformers and solenoids against burnout.

Fusetron DUAL ELEMENT Fuses

Give All-Purpose Protection

because . . .

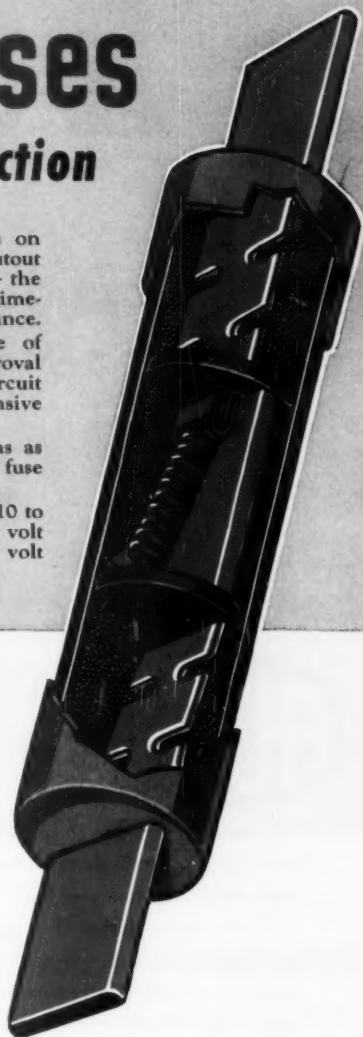
The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.



DON'T RISK LOSSES

One needless shutdown . . .

One lost motor . . .

One destroyed switch or panel . . .

May cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse

MAIL THE COUPON NOW for complete information about Fusetron Fuses and their 10 point all-purpose protection

FUSETRON is a trade mark of the
Bussmann Mfg. Co., Division of
McGraw Electric Co.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element
FUSES.

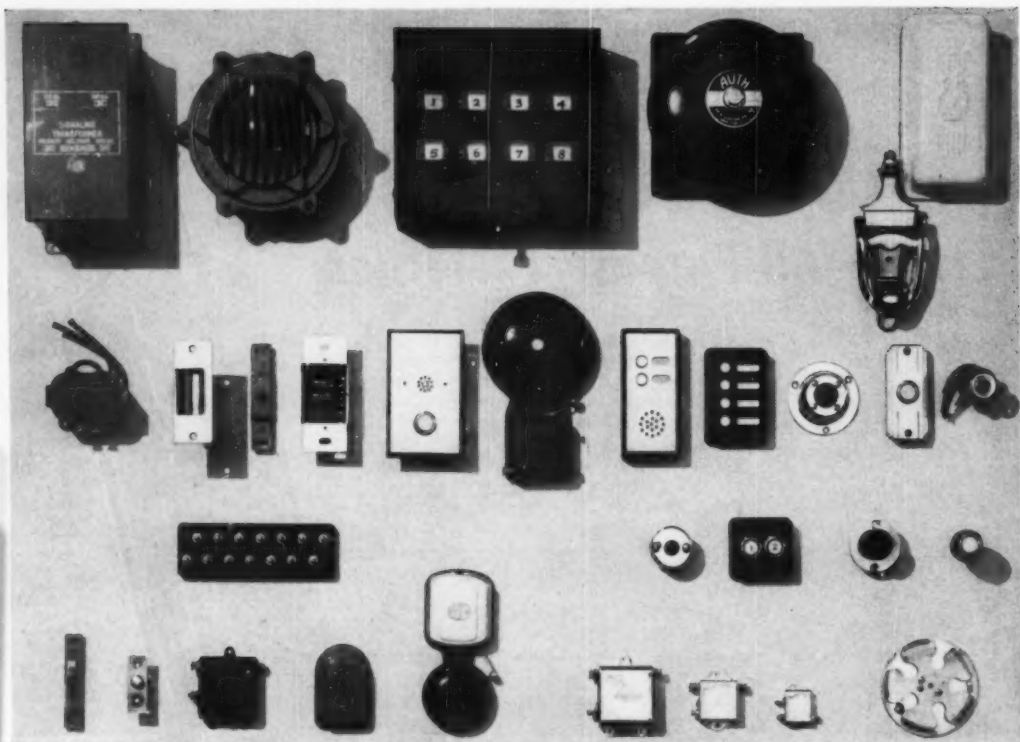
Name

Title

Company

Address

City & Zone State ECM 4-50



A COMPLETE Source for Signaling, Communication and Protective Equipment

You save time, temper and money by eliminating purchasing, delivery, transportation and inventory headaches—and you give your customers faster, more complete service—when you can get a complete line of signaling, communication and protective devices and equipment from one reliable source. Auth is such a reliable central source, and has been since 1892. Over 58 years the word of AUTHority for tested equipment, designed for long, trouble-free service.

Write today for new catalog describing the whole Auth Line.

MANUFACTURERS OF

Electrical Signaling, Communication and Protective Equipment for Housing, Hospitals, Schools, Offices, Ships and Industry.



AUTH ELECTRIC COMPANY, INC.

34-20 45TH ST., LONG ISLAND CITY 1, NEW YORK

- AUDIBLE SIGNALS
Bells, Buzzers, Chimes (Non-Electric), Sirens, Horns
- ANNUNCIATORS
- PUSH BUTTONS
- TRANSFORMERS
- BURGLAR ALARM DEVICES
- FIRE ALARM SYSTEMS
- INTERCOM TELEPHONES
- APARTMENT MAIL BOXES
TELEPHONE, BELL SYSTEMS
- CLOCK & PROGRAM SYSTEMS
- HOSPITAL SIGNALING
SYSTEMS



TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

will run safely without relubrication for as long as any general-purpose motor you can buy—

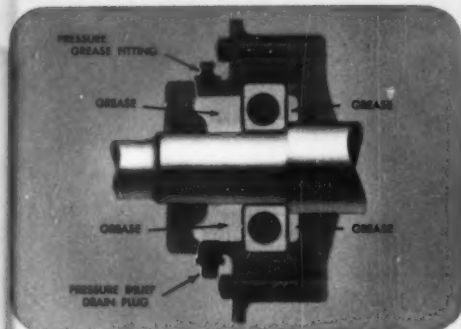
and if the application makes relubrication a must, you can grease a ***TRI/CLAD*** without halting production

GENERAL  **ELECTRIC**

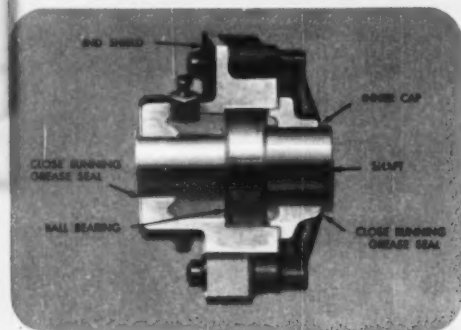
**HERE'S
WHY**



- 1 EXTRA BEARING PROTECTION** — Tri-Clad gives you extra bearing protection because heaviest standard-service bearings are carefully selected to withstand severe loads for long periods.



- 2 EXTRA GREASE** — Four times the ordinary amount of grease is packed into the large Tri-Clad grease reservoir. Since bearing life depends on grease, this means that Tri-Clad motors will run safely for years — for as long as any general-purpose motor you can buy.



- 3 SEALED-IN BEARINGS** — Bearings and grease are completely sealed in a cast housing with long running seals for extra protection from dirt, dust, and lubricant leakage.

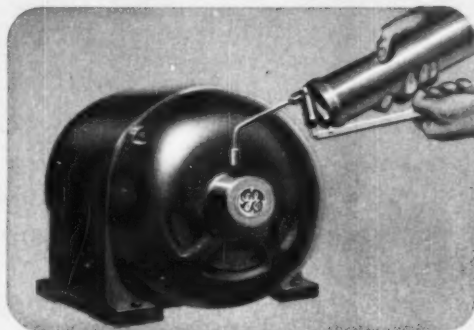
TRI-CLAD MOTORS will run safely without relubrication for as long as any general-purpose motor you can buy—

Tri-Clad extra lubrication "protection" can save you money because:

1. Tri-Clad's oversize grease reservoir and the heaviest standard-service bearings mean you do not have to bother with greasing between motor check-ups.
2. When relubrication is needed on those tough applications, you can grease a Tri-Clad without interrupting production-line operations.

Tri-Clads are grease-gun easy to lubricate *on the job*. Moreover, a Tri-Clad motor will run safely where an ordinary motor would fail. Chances are you'll be spared the cost of a "special" motor.

YOU BE THE JUDGE! The best way to prove to yourself that Tri-Clad gives you the most for your motor dollar is to contact your local G-E office. Tri-Clad stocks are complete. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



- 4 PRESSURE-RELIEF GREASING** — An efficient system of pressure-relief lubrication (with standard fittings) enables a Tri-Clad motor to be quickly and easily greased on the job when and if it's needed.

GENERAL  **ELECTRIC**

Repair Electrical Appliances and Utilities

THE NEW MODEL 50

UTILITY TESTER



Compact—Measures 3 1/8" x 5 3/8" x 2 1/4"

- Will test condensers for both opens and shorts.
- Will accurately check and locate the exact cause of failure in 3 way heat control switches.
- Will check field coils for opens and shorts.
- Will indicate when one side of an appliance or motor connected to the line under test is "grounded."

A NEW KIND OF INSTRUMENT FOR TESTING ALL ELECTRICAL CIRCUITS AND APPLIANCES SUCH AS—

- RANGES
- SHAVERS
- HEATERS
- IRONERS
- WASHERS
- FANS
- VACUUM CLEANERS
- AIR CONDITIONERS
- REFRIGERATORS
- SUN LAMPS
- TOASTERS
- WASHING MACHINES and MOTORS

[ALL MOTORS—single phase, multi-phase, universal, squirrel cage, induction, in fact every type of motor from fractional H.P. to 2 H.P.]

THE MODEL 50 UTILITY TESTER:

- Will measure the actual current consumption of any appliance or utility either A.C. or D.C. and will measure it while the unit is in operation. The reading will be direct in amperes. The appliance or utility may be plugged directly into the front panel receptacle. A special pair of insulated clip-end leads is included for motors, etc.
- Will measure the actual voltage and indicate whether the current is A.C. or D.C. and if the frequency is 25 cycles or 60 cycles.
- Incorporates a sensitive direct-reading resistance range which will accurately measure all resistance commonly used in electrical appliances, motors, etc. This range will enable continuity checks and tests for shorts and opens.
- Will indicate excessive leakage between a motor and a line up to 10 Megohms.
- Will indicate when a three-phase motor is running erratically due to a "blown" fuse.
- Will test Thermostats under actual working conditions.
- Is the ideal trouble-shooter as it will instantly locate opens, shorts and grounds.
- Will test all bulbs, radio tube filaments, pilot light lamps, all fuses including cartridge, screw, etc., fluorescent bulbs, etc.

SHIPPED ON APPROVAL NO MONEY WITH ORDER—NO C. O. D.

TRY BEFORE YOU BUY! Yes, you need send no money with order or pay anything on delivery. Simply fill out this order form and mail it today. Try the Model 50 for 10 days. If completely satisfied, remit \$13.90. If not, return the instrument—no explanation necessary.

The Model 50 Utility Tester comes housed in a round cornered molded bakelite case. Complete with all test leads and operating instructions—only . . .

\$13⁹⁰

GENERAL ELECTRONIC DISTRIBUTING CO.
98 PARK PLACE, NEW YORK 7, N. Y.

EC-415

Please rush one Model 50 Utility Tester. I will either remit \$13.90 after a 10-day trial or return the instrument via Parcel Post.

Name

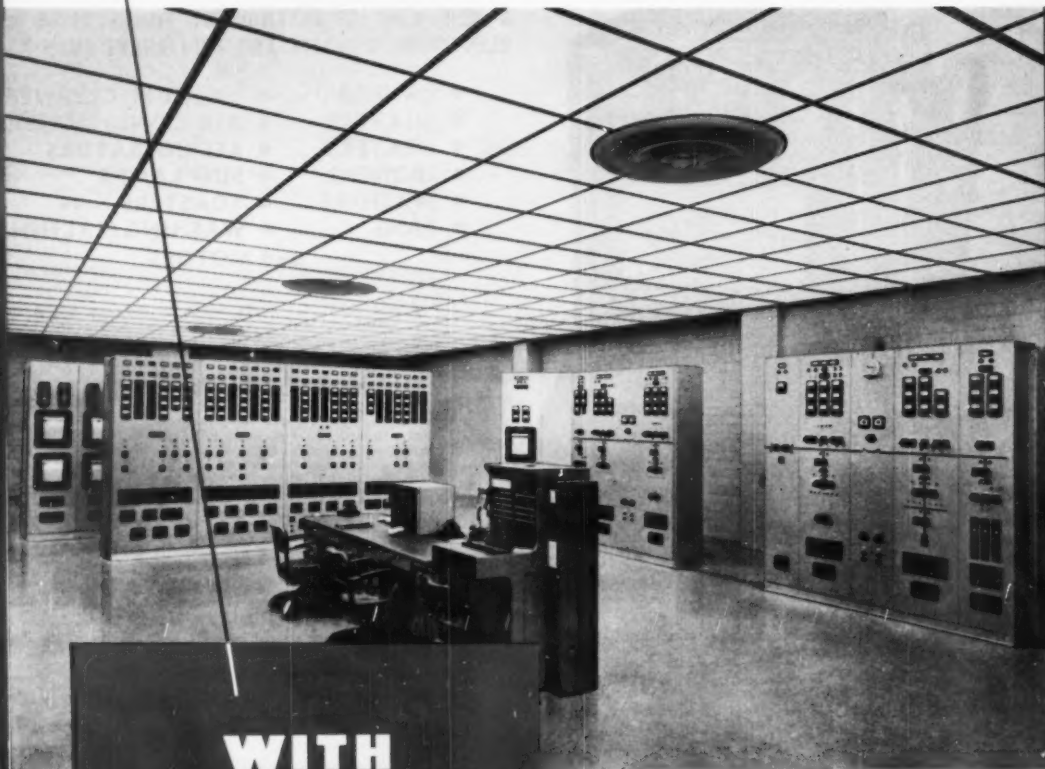
Address

City State

FREE PREMIUM!!

☐ Check here if you include \$13.90 payment with order. In return for saving due to bookkeeping, we will include a set of 6 assorted key chains with your Model 50. If the Model 50 does not meet with your wholehearted approval after a 10-day trial, return it for full immediate refund of \$13.90—keep the premium for your trouble.

VISIBILITY UNLIMITED -



**WITH
PLEXIGLAS
QUALITY
LIGHTING**

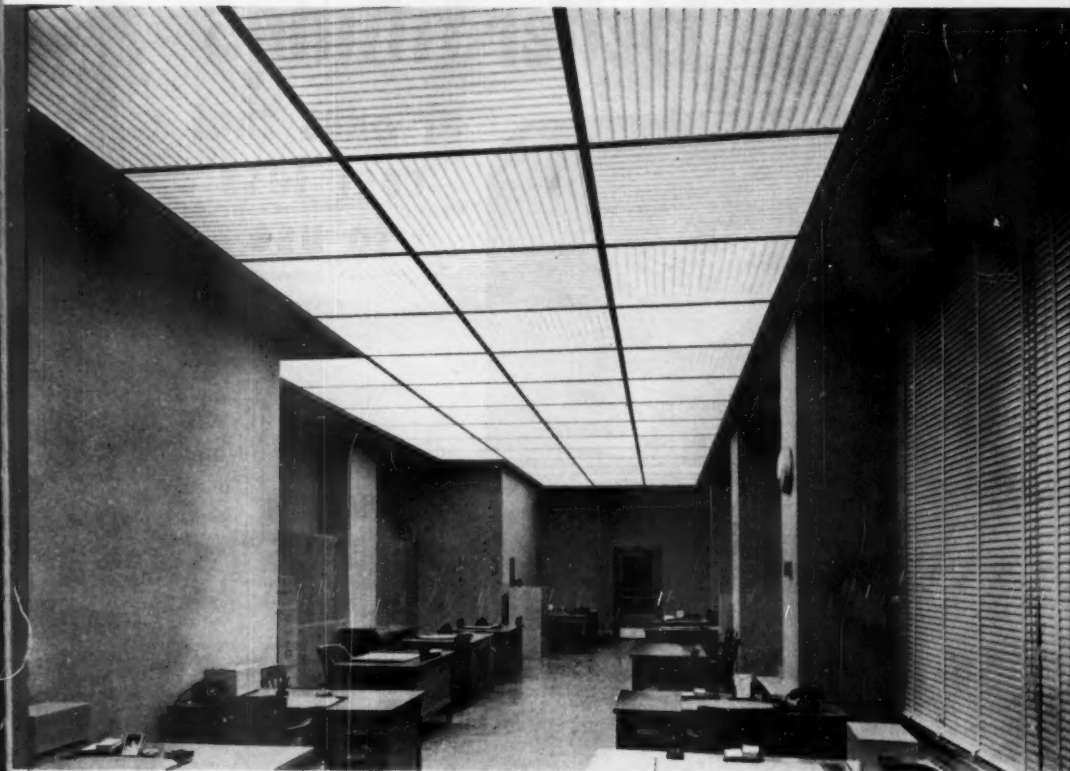
A Lighting Fixture As Big As The Room. PLEXIGLAS diffusing panels in control room of Philadelphia Electric Company generating station. Large sections of white translucent PLEXIGLAS, installed wall-to-wall below cold cathode tubes, give excellent glare-free illumination.

Three things happen when you install PLEXIGLAS Lighting Fixtures:—

Glare and eyestrain take a permanent holiday.
Personnel efficiency and morale go kiting.
Lighting maintenance tumbles to a new low.

White translucent PLEXIGLAS diffuses light so completely that glare simply vanishes. Brightness ratios are remarkably low, yet minimum absorption and maximum transmission of light give full, even illumination throughout any room. Maintenance costs are negligible because PLEXIGLAS is light, strong, shatter-

EYESTRAIN ZERO



No Glare—No Shadows. Installed by Texas Electric Service Co., Fort Worth, in their own sales office, this wall-to-wall luminous ceiling gives glare-free, completely diffused illumination throughout the room. Footcandle reading is 99, with diffusing panels—110 without panels. This remarkable efficiency is possible only because white translucent PLEXIGLAS absorbs no light. Corrugations run in opposite directions in adjoining panels, providing an interesting decorative pattern. Lighted by 66 T12 Slimlines operated at 425 ma and 107 T8 Slimlines operated at 200 ma.

resistant—proof against discoloration from fluorescent lighting.

Because PLEXIGLAS weighs less than half as much as glass, it's easy to install—even in large sections for wall-to-wall luminous ceilings. And because PLEXIGLAS is easily cut, shaped, machined and fabricated, it adapts readily to coffer, cove or trough lighting, completely enclosed units, wall or overhead lighting of all kinds. For full details of PLEXIGLAS Quality Lighting in banks, stores, drafting rooms and classrooms, send for free literature today. There's no obligation.

WRITE FOR THIS FREE LITERATURE TODAY...

and ask any questions you wish about PLEXIGLAS acrylic plastic for lighting.



PLEXIGLAS is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.

CHEMICALS



FOR INDUSTRY

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COMPANY**

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Representatives in principal foreign countries

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Distributor:
Crystal Glass
& Plastics,
Ltd., 282 St.
Helena Avenue,
Toronto, Ont.*

You can't buy Better Fittings

or ones that
cost less
to use



Quicker to use and neater in appearance, Briegel All-Steel Indenter Fittings not only make stronger connections but also make each job more profitable to the contractor and satisfactory to his customers.

Two Easy Squeezes and they're set to stay. It is only natural that the Briegel All-Steel Indenter Fittings are the most widely used E.M.T. connectors and couplings. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job neater, stronger and better.



All B-M Fittings Carry the
Underwriters Seal of Approval



BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

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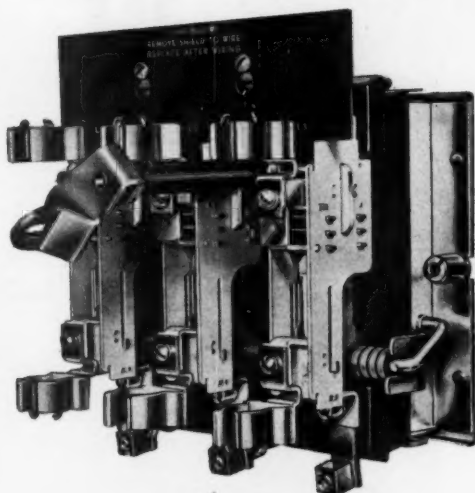
The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Enameled Metals, Pittsburgh, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

TRUMBULL'S HCI

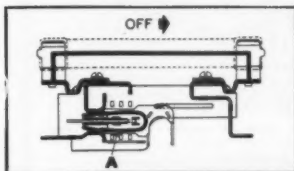
HIGH CAPACITY INTERRUPTER

Unusually high interrupting capacity... "circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity... withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.

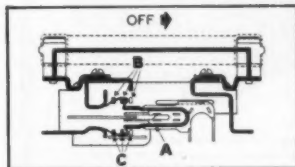


Here's How...

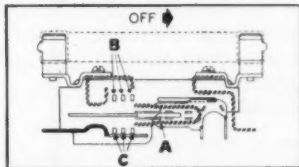
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Heavy line is current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE- SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation... give low-resistance contact.

Insulating parts made of linen melamine, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

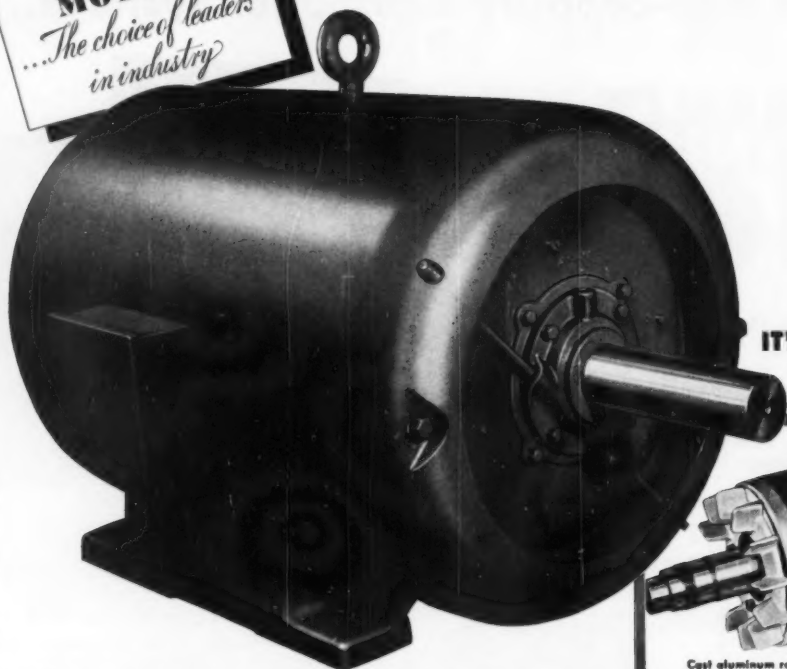
TRUMBULL ELECTRIC



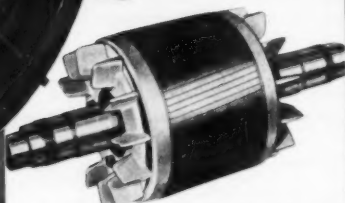
TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

**WAGNER
MOTORS**

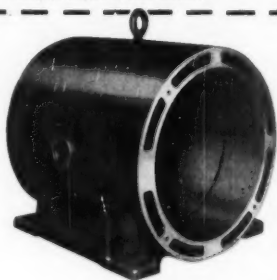
*...The choice of leaders
in industry*



**IT'S WAGNER
*because:***



Cast aluminum rotors, pioneered by Wagner, provide inherent mechanical and electrical characteristics that add quality and dependability to Wagner type CP Motors.



The rugged frame, used on Wagner type CP Motors, has extra large air ducts around the entire stator to prevent clogging and to permit plenty of fan-driven air to cool the motor.

Wagner Totally-enclosed Motors best for really dirty jobs!

Wagner totally-enclosed fan-cooled motors are designed for a particular purpose—to operate efficiently and safely under conditions that would quickly damage an ordinary open type motor. In really dirty jobs—in atmospheres filled with dust, fumes, moisture, abrasives, steel chips and other harmful elements—these *protected* Type CP Motors keep on working, delivering dependable power with no maintenance other than periodic lubrication. Wagner totally-enclosed fan-cooled motors are varied electrically to suit a wide variety of application requirements. Bulletin MU-185 gives complete information on Wagner Motors. Twenty-nine sales and service branches, in principal cities, are ready to help you on any motor problem. In addition, almost 500 authorized motor repair shops provide speedy, nationwide service facilities.

Wagner
Electric Corporation

EST. 1891

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS • AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES

THE MOST

Beautiful

INDIRECT INCANDESCENT LUMINAIRE



The New Curtis **SNO-FLAKE**

DECORATIVE ❄️ **EFFICIENT** ❄️ **ECONOMICAL**

Curtis SNO-FLAKE presents an entirely new concept of design for indirect incandescent illumination. It combines startling beauty with many functional features. The SNO-FLAKE'S high efficiency and economy in installation and maintenance make this excellent new unit ideal for school rooms, offices, stores, and other commercial interiors. The die-cast aluminum louver follows a pleasing geometric pattern that blends with any decorative scheme. Open top and bottom, this louver requires a minimum of maintenance. Original efficiency of the luminaire is regained with each relamping. The SNO-FLAKE utilizes either 300 or 500 watt silvered bowl lamps which assure the high efficiency demanded for modern illumination.



LIGHTING, INC., 6135 W. 65TH ST., CHICAGO 38, ILLINOIS

Full technical details and specifications on the SNO-FLAKE are illustrated and described in Bulletin No. 8. Write Dept. SF-47 for your free copy to supplement your Curtis Catalog.

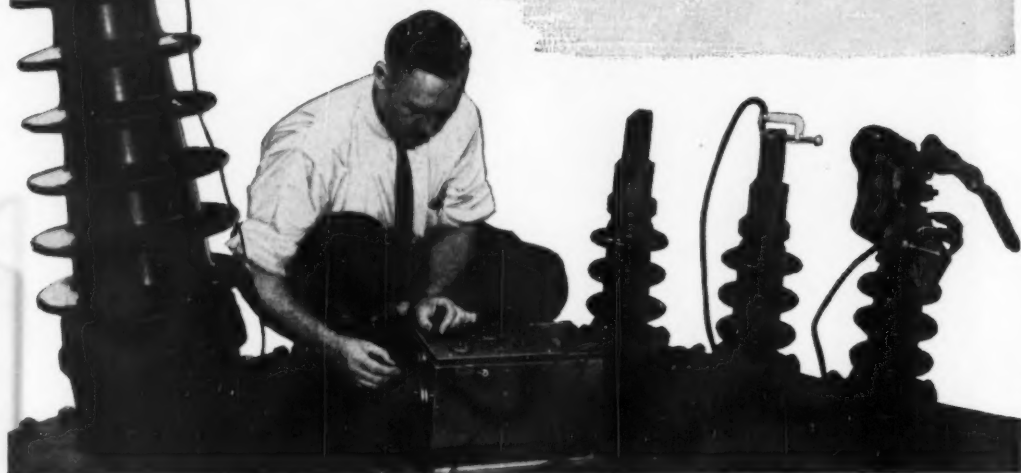


Diagnose Transformer Trouble

in the field

reduce delay and expense

spot trouble while in service position



THE BIDDLE TRANSFORMER TURN RATIO TEST SET is a *New Tool* in transformer work

It is designed for use on power and distribution transformers, including auto-transformers.

It provides for the first time a portable device for measuring turn ratio with high precision.

It can be carried anywhere, to the top of large transformers, in the transformer shop or stock location.

With it you can:

- Measure the turn ratio of new, repaired and rewound units, both power and distribution types.
- Check polarity.
- Quickly identify leads and taps.
- Check tap-changer settings.
- Investigate load division and circulating current between units or banks.
- Detect shorted or missing turns.
- Locate concealed faults.

The "TTR" Set is essentially a reference transformer with characteristics—in respect to measurements of turn ratio—that match those of the power and distribution transformers you desire to test. Its ratio is adjustable from 0 to 130 and measurements are easily obtained by direct reading from the indexes of four dial switches using the null-balance comparison system. It features a hand-cranked, 8-volt a-c generator which renders it independent of any outside source of current. Hence, it is a safe and practically shock-proof, one-man instrument.

Owners of the "TTR" Set tell us that in the short time they've used it, it has paid for itself in analyzing conditions in transformers during manufacture, at installations, and in maintenance and trouble work. For the price, and more detailed descriptions of the "TTR" Set, we invite you to send for Bulletin 55-ECM.

JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

1316 ARCH STREET, PHILADELPHIA 7, PA.

Megger®

INSULATION TESTERS • GROUND TESTERS • OHMMETERS

YOU SELL MODULE INSTALLATIONS



General Office. Chicago, Ill.



Bank. Wheeling, W. Va.



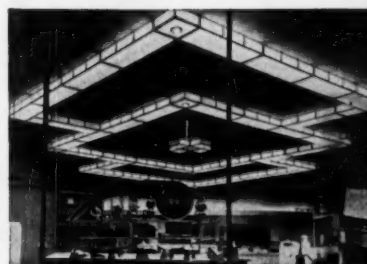
Automobile Showroom. Ecorse, Mich.



Display Room. Dallas, Texas



Utility Showroom. Trenton, Mich.



Appliance Store. El Dorado, Ark.

LIKE THESE

WHEN YOU TELL THIS SELLING STORY

module is custom-fitting

Here's the *new* lighting that *fits* any commercial interior to a "T". Four basic MODULE units are the "building blocks" or "dominoes" of light. They fit together easily, economically, to form over 50,000 different patterns. They custom-fit any room shape or size. They put the light *exactly* where it's needed. MODULE is the *only* lighting that *custom-fits* with standard low-cost units.

module delivers 20% MORE LIGHT

Proved in actual use—MODULE delivers 20% EXTRA light per unit! Yes—the MODULE translucent plastic molded louver passes 20% MORE LIGHT. This means more light per dollar—fewer fixtures required to meet footcandle specifications. This means *more* light, *better* light at no more than the cost of ordinary fixtures.

module installations are never obsolete

No MODULE lighting system is ever obsolete. Here's why: As lighting needs change, more units can be added at any time, at any point in the system—without installing a single new electric outlet box because MODULE units connect together electrically and mechanically. MODULE lighting is never "locked-in"—the "building blocks" of light simply slip into place easily and economically exactly as required.

module is newest, finest

And there's nothing in lighting that will *stay* newer and finer than MODULE. Yes—a MODULE installation remains modern for years, because: it custom-fits and "grows" with every lighting need; it delivers *more* light; its appearance has an undated "always contemporary" look. No ordinary fixtures can match these MODULE advantages.

TELL THIS STORY—IT SELLS



REG. U. S. PAT. OFFICE

IF YOU HAVEN'T ALL THE
module FACTS, WRITE TODAY

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Avenue • Chicago 14, Illinois

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Apply the SURE CURE for Frigid Furnaces!

Slow to heat? Uneven temperatures?

When a well-designed resistance furnace fails to do its job quickly, efficiently, check first for these points: (1) Lengthy service wiring. (2) Overloaded circuit. Either means power loss. Correct this quickly, economically.

APPLY THE SURE CURE. Bring high-voltage power close to load centers with Westinghouse Dry-Type Transformers.

With long runs of secondary wiring, the power that should heat the furnace is wasted heating the line. Circuit overload causes an equally costly power drop. *A loss of 12% of rated voltage reduces heat generation to 77% of normal.* But taking high-voltage power close to secondary loads reduces voltage drop and minimizes power losses.

Because Westinghouse Dry-Type Transformers are smaller and lighter, they can

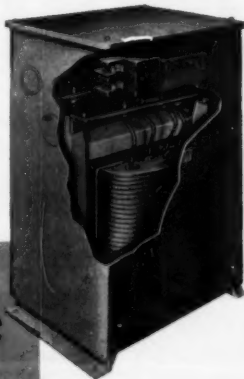
be installed easily. There is no need for fireproof vaults—mount them overhead, on shelves, posts, or platforms. Welded sheet steel cases completely enclose the transformer for safety and a trim appearance.

You can be sure of effective correction of overloaded circuits and power losses with Westinghouse Dry-Type Transformers. For complete details, write for booklet B-4009. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70535

NOW AVAILABLE WITH BUILT-IN CIRCUIT BREAKER

New Types AJRB and AVRB give you a transformer and circuit breaker in a single, compact package. The need for separate protective devices is eliminated.



Westinghouse

DRY TYPE TRANSFORMERS

FOR SAFETY'S SAKE . . . USE CONDUIT (Full Weight Rigid Steel)

Rigid steel conduit for rigid controls

CABLES that power thousands of controls must have absolute protection. That's why Buckeye Full Weight Rigid Steel Conduit is like insurance. Shock-proof, dust-proof, moisture-proof, it gives positive protection in the most hazardous locations.



Youngstown

BUCKEYE CONDUIT

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yaloy Steel

General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

CONDUIT · HOT AND COLD FINISHED CARBON AND ALLOY BARS · PIPE AND TUBULAR PRODUCTS · WIRE ·
ELECTROLYTIC TIN PLATE · COKE TIN PLATE · RODS · SHEETS · PLATES · RAILROAD TRACK SPIKES

APRIL . . . at a Glance

Maintenance

With the rigors of modern production schedules and the pressure on break-even points and like industrial problems, shutdowns as a result of electrical system or equipment failures are well-nigh intolerable. Fortunately, most are preventable by appropriate planning and preventive maintenance schedules. Industrial Editor Hugh Scott has reviewed the preventive maintenance problem on four major classes of electrical equipment in his article, "Preventive Maintenance", beginning on page 51.

Estimating

To get detailed quantities from the usually sketchy plan data on feeders and power circuits needs a systematic approach to this part of the estimate take-off. In the fourth article on "How to Estimate Electrical Work", beginning on page 56, we develop the use of the feeder diagram in planning take-off, the use of detailed sketches to develop quantities on special segments of the work, the use of the feeder schedule, their listing quantities and the intermediate summary for accumulating like materials.

Electronic Tubes

With the growing use of apparatus involving industrial electronic tubes, the care of these devices falls to the electrical maintenance department or the maintenance contractor. A basic understanding of the differences in such tubes and their operation, based upon cathode structures, is essential background. H. J. Dailey has given us a precise analysis of these differences and the maintenance considerations in "Care of Industrial Tubes", beginning on page 66.

Speed

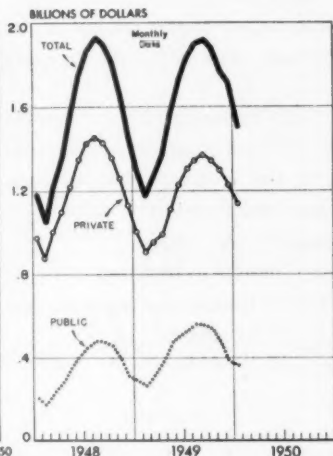
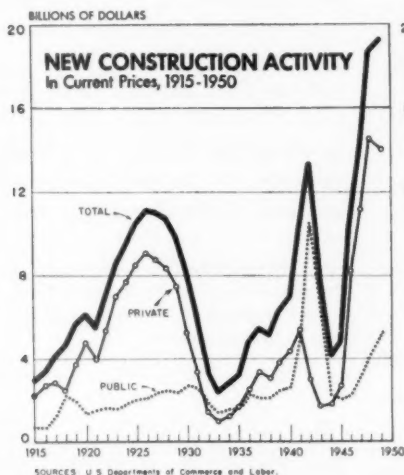
Trouble-shooting and maintenance of motor driven equipment requires an exact knowledge of operating speeds. From the speed, together with the electrical measurements of circuits feeding the equipment, substantial data is derived and accurate diagnosis is possible. Stuart C. Sommer presents in this issue, page 81, an excellent review of the various instruments and apparatus available for speed measurement.

Light Sells

The influence of effective lighting techniques for merchandising hardly needs further emphasis in these pages. Many articles and reports have covered the advantages of planned lighting merchandising operations. Chandler's new State Street store in Chicago, is an excellent case study of lighting designed to achieve merchandising results. Designer Leonard James tells the story in "Case Study in Lighting for Shoe Sales", beginning on page 68.

Behind the Job

Organization of trucking, stocks, tools, and job manning is essential to a large volume of business, such as that of the Lightning Electric Service Company of Newark. From a big operation like this, however, there are many useful ideas applicable to all kinds of electrical construction operations. In "Blueprint for Construction", page 62, you will find plenty of directly usable ideas and a good check against your own "behind the job" organization.



It takes a tough farm wire to get along with a cow!



Frankly, it takes **DURALL**

Life on a farm is tough for any wire. Mold, fungus, moisture, acids and animal matter rot jacket and insulation of ordinary wire with discouraging efficiency.

But DURALL®, with its tough Neoprene jacket and insulation, is designed especially for farm installation. Not only can it stand up under such attacks, but it's also toughly resistant to:

**alkalies • oils • flame
crushing • impact • abrasion**

because DURALL has no fibrous covering to rot and fray; no metallic sheath to corrode.

These are the reasons why you should recommend DURALL to your farm customers. It's the soundly engineered wire for exposure—on farms, in factories—wherever wiring has to meet severe conditions.

If you don't know all about DURALL, ask your nearest Anaconda Sales Office or your Anaconda Distributor for literature and information. It's the right wire for the job. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

045229

FULLY APPROVED! The Underwriters' Laboratories have approved DURALL for use in cow barns and other locations where it is subject to all types of exposure normally encountered in farm installations.

©Reg. U. S. Pat. Off.

the right wire for the job— **ANACONDA®**
WIRE AND CABLE

FARM WIRING PROGRESS

RURAL POWER LINES will be connecting new customers at a slower rate when the pioneer farm wiring era begins to retire into history. The percentage of farms which do not have access to power lines has declined rapidly since the war. A new and potentially more significant era of rural electrification, however, is already under way. Farm wiring and farm loads are taking on a unique character, far beyond the scope of the usual initial installation.

HOUSEHOLD APPLIANCES and lighting were, and still are, the first phase of farm electrification. Initial installations when new lines are energized are little different from city or suburban residence jobs. In a relatively short time, however, the farmer begins to use his new energy source in applications peculiar to farming. Through co-op meetings, agricultural school bulletins and other information sources, he learns how. And in a prosperous farm economy he is quick to take advantage of labor-saving electrical services.

REWIRING, MODERNIZATION and extension of electrical facilities is appearing as an important market for electrical work while the original copper is still bright. Unlike residential rewiring, the problems do not lend themselves to the temporary and dangerous solution of octopus outlets and extension cords. They are related more to the frequent and expert additions and alterations required in industrial plants as machines and processes are developed for more efficient operation.

INDUSTRIAL WORK in smaller plants which present an electrical problem somewhat similar to the electrified farm shows the way to serve this important farm wiring market. Skilled electrical service organizations, on call, equipped to handle the specialized problems of farm wiring are the answer. They already exist in communities serving many farm areas. Where they don't, they can be built. The business opportunities are large and rewarding.

WHY NOT TRAIN THE FARMER to wire his own equipment? He will if he has to. But to tie a vital phase of farm electrification progress to amateur wiring would be folly. The modern farmer is a business man competent and willing to buy expert services. Trouble free operation and certain safety are even more important to him than to other users of light and power.

THIS EXPANDING ERA of farm electrification needs the kind of contractor who is willing to develop and earn the confidence of his farm customers. It will grow on old fashioned service and scrupulous business integrity. It has no place for the sharp pencil or the fast price. The initiative in the further progress of farm wiring belongs to the contractor. There's a big opportunity waiting.

Wm. F. Stuart

ELECTRICAL CONSTRUCTION AND MAINTENANCE



FRESH AIR

can boost your business!

Remove fumes, excess heat, dust with ILG units

Employers know that when there is proper and adequate ventilation, employees are more comfortable and thus more efficient. ILG blowers and fans — distributed by Graybar — are the best-designed, best-built units you can provide. All ILG equipment is built on the "exhaust" principle and is designed to provide complete and frequent air change. For each of your customers' ventilating needs, there's a standard unit that's "made for the job."

HEATING, DRYING UNITS AND ACCESSORIES

Graybar not only has the proper equipment for ventilating any room — or an entire plant — but also has unit heaters for space heating or drying . . . plus all the accessories you need, including controls and wiring supplies.

Free ventilation planning bulletin!

Here's a new 32-page booklet that's crammed with ventilating information and diagrams. The booklet, "How to Plan Your Ventilation System," describes how to figure air-change requirements; how to select the correct-size fan; how proper ventilation can increase employee productivity; and hundreds of other facts that are important to you and your customers. Be sure to get your copy — it's ready now.

Convenient source for everything electrical

Graybar distributes more than 100,000 electrical items — including many contractors' tools — for wiring, lighting, communication, power, and many other electrical needs. Graybar Specialists are on call to help you survey your customers' buildings to determine the best ventilating systems, or to help solve any difficult electrical problem. Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.

Send coupon for FREE Booklet

Graybar Electric Company, Inc.
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Please send me my copy of the 32-page booklet "How to Plan Your Ventilation System."

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

You get the best of
everything electrical
Via Graybar

PREVENTIVE MAINTENANCE

- Transformers, switchgear, motors and controls *must* remain operative to maintain production.
- Operation depends upon planned inspections, comprehensive check-lists, proper tools and practical know-how.
- Here are some successful, time-tested hints and methods for insuring continuity of electrical operation.

By Hugh P. Scott

SHORT on elegance yet long on logic is this definition of preventive maintenance: "Doing something *now* when you *don't* have to do it so you won't have to do it *later* when you *have* to." It's as simple—and as important—as that!

The value of preventive maintenance cannot be overstressed, for equipment is of little value when either inoperative or operating ineffectively. Unless equipment remains trouble-free, peak efficiency is impossible. And peak efficiency is the basis for all operations; all production. Preventive maintenance, therefore, becomes synonymous with plant economy, efficiency and safety. It holds the solution to industrial production; production which depends upon continuous, efficient service of electrical equipment which, in turn, is the resultant of sound engineering, careful selection, installation "know-how", intelligent operation and *preventive* maintenance.

As distinguished from breakdown repairs, preventive maintenance includes the important factors of planned shut-downs, periodic inspections, comprehensive records, adequate stocks of replacement parts, a skilled maintenance organization, proper tools and instruments. Going further, these factors can be subdivided to include supervisory and working personnel, the use of check-lists, plant surveys, schedules and control boards, inventories, cost analysis, safety provisions and purchasing procedures.

In scope, practically everything connected or related to the electrical system should be considered. This in-

cludes service entrance, overhead lines, conduit systems, panelboards and switchgear, grounds, transformers, circuit conductors and breakers, control equipment, motors and generators, ventilating equipment, heating apparatus, special equipment for hazardous locations, lighting, signals and communication systems, underground wiring, industrial trucks and welding equipment. This listing merely suggests the wide scope. It does not attempt to be all-inclusive.

Any of these points can be expanded indefinitely, but let us focus our attention on a single line, running from transformers through switchgear and controls to motors.

Transformers

Since improved efficiency is the primary objective of preventive maintenance, *anything* resulting in improved efficiency can theoretically be placed in this realm. In the case of transformers, therefore, it can start with the planning and installation stage—considering the inclusion of transformers as a segment of a unit substation or load center. The resultant benefits are many; including easier installation, reduced maintenance, greater adaptability, increased safety, conservation of space, concentration of responsibility, coordinated engineering, greater flexibility, less costly feeder breakers and cable runs, improved voltage regulation, allowance for future expansion and greater short-circuit protection.

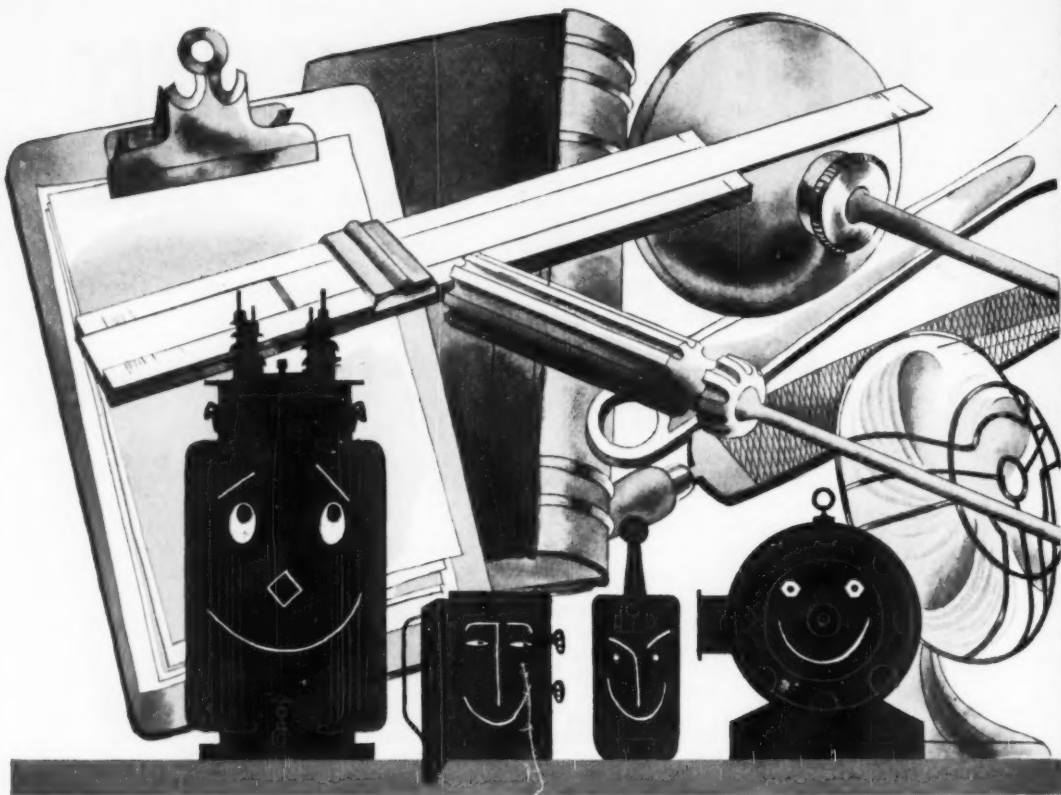
Transformers should be treated with respect, for they are the liaison between voltage levels: the stepping

stones from utility lines down to plant distribution and ultimate utilization voltages. To utilize their full capacity, it is important to:

1. *Balance the loading.* This should be a plant-wide procedure. A few simple transfers can improve the entire system, removing overloads from some transformers while placing near-rated loads on units which are operating far below their capacities. Balancing of loads on a 3-wire 115/230-volt circuit is an example close-to-home in many plants, for a heavy unbalance will result in high neutral currents, seriously overloading transformer windings.

2. *Provide adequate ventilation.* Keep the flow of air past cooling tubes or radiating surfaces unobstructed. The addition of fans is one way to increase cooling. Another—with units having air ducts and open ventilation—is to thoroughly clean the ducts and coils to insure maximum ventilation.

3. *Use capacitors or voltage regulators.* The value of capacitors is particularly high in plants with the bulk of the load made up of induction motors. For their required magnetizing current, with a resulting lagging power factor, creates an unused current component—which we know as reactive current. By supplying this necessary reactive current by means of a capacitor placed right at the motor, the required line current is reduced while the same horsepower output is maintained. The value of regulators is also apparent; maintaining uniformity of transformer characteristics regardless of fluctuating load demands.



SHUTDOWNS ARE TABOO in modern industry. The solution is found in preventive maintenance . . .

4. Check oil conditions. Periodic samples of oil should be tested in a standard spark gap test cup. A low dielectric strength indicating the presence of moisture, is a warning that the voltage capacity of the transformer is reduced—perhaps below the safety point. Visual inspections can reveal sludging conditions and, when this condition is present, the oil should be filtered and tested for acidity. Sludge, a sure sign of oil deterioration, may result in clogged cooling ducts and hot spots.

5. Maintain oil level. When oil is at 25 degrees C, keep the level up to the gauge line and, while the transformer is in service, make sure that the level does not drop entirely from view. Low oil can cause overheating, improper circulation—even internal flashovers. Conversely, high levels can cause overflowing at high temperatures.

Dry Type Transformers

Maintenance should also include dry

type transformers. Regardless of how satisfactorily a dry type unit may be, it should be thoroughly inspected at least once a year checking all electrical connections for tightness and insulation and, where necessary, repainting cases and other parts.

Dust and dirt can change corona values greatly, reducing insulation safety factors, so windings and internal assemblies, especially leads, lead supports and terminal boards, should be checked for this condition. When dust is found on the windings and other surfaces, the transformer should be de-energized and cleaned with either vacuum equipment or dry, clean (less than 40 psi) compressed air. Since higher pressures frequently force dirt further into the varnish and also may damage fragile insulation, the preference in cleaning is for vacuum equipment.

Some plants find that *check-lists* prevent maintenance men from forgetting some minor procedures. Some such lists are fairly general but they

serve their intended purpose. A check-list for transformers might read as follows:

Voltage—Check primary and secondary voltages with a voltmeter to see that rated voltages are being delivered.

Load amperes—Take load tests on the secondary side with an ordinary or recording ammeter to prevent equipment overloads.

Insulation—Take resistance readings with a Megger to guard against unheralded insulation breakdowns.

Oil condition—Check the conditions of the oil in the oil-cooled units to see that the oil is clean and its dielectric strength is maintained.

Oil level and temperature—Check oil level and temperature gauges daily to see that unit is properly cooled and no overload might occur.

Connections—Make inspection of all connections to guard against poor contact due to vibration, heat or mechanical or electrical stresses.

Grounding—Check all equipment



FOR VIBRATION, MOISTURE, dust, dirt, sludge, loose connections and overloads have no place in plants.

and system grounding connections, for vibration or corrosion might loosen them.

Switchgear

Switchgear may control high or low-voltage circuits; may be stationed outdoors or in; may be part of a unit substation or load center or it may be segregated in its location. It may serve main feeders or branch circuits. But regardless of position or capacity, it has two important purposes: to *control* the flow of current and to *protect* equipment, materials and personnel. For these reasons, switchgear and controls should be judiciously selected, carefully installed and properly maintained.

To promote flexibility and interchangeability of component parts, there is a growing trend towards manufacturing switchboard sections with standard heights, widths and depths so that sections can be easily combined to provide the desired capacities and functions. Panels are

generally dead-front die-formed, welded or bolted construction, with electrical details varying in accordance with the intended use of the equipment at the main switching center, distribution point or at-the-spot local control panel.

For example; switching center units might utilize fusible knife switches or thermal circuit breakers for amperages up to 600 volts, with air circuit breakers having overload trips and undervoltage protection for amps up to 5000. When used at distribution points, the disconnecting means might take the form of a circuit breaker or fuses. This indicates that, from a construction point of view, switchgear can vary widely. But they have one thing in common: they all require maintenance.

Frequent inspection, tightening of bolted contacts, adjusting, cleaning and lubrication of switchgear and panelboards is essential, and the loading of these units should be checked whenever a plant change occurs.

The location of equipment can make a big difference in the maintenance required, for electrical equipment in general purpose enclosures must be protected from moisture, dust, vibration and excessive temperatures. Rain-tight, splashproof and weatherproof enclosures are recommended for locations where water is used for washing equipment, walls or products. Dust- and semi-dust-tight enclosures are recommended where atmospheres contain metallic particles, non-inflammable dust or abrasive materials. And, of course, NEC provisions should be followed where atmospheres are explosive.

Switches

When switches are being inspected or serviced, it is imperative that the circuit is locked open at a point ahead of the safety being checked. To be sure of this, a voltage tester should be used before any work is begun. After the circuit is dead, preventive maintenance procedures include:

1. **Cleaning.** This can be accomplished by a dry cloth, compressed air or vacuum. Cleanliness has several purposes, for dust accumulations within the enclosure will tend to decrease the radiation of heat from current-carrying parts, it will reduce the freedom of moving parts and—when metallic particles are present—it can lead to grounding or flash-over of live parts.

2. **Tightening.** Alternate cooling and heating, as well as vibration, frequently loosens screws and nuts. For positive connections, this fault should be guarded against.

3. **Contacts.** Cleaning should include more than the removal of dust, for film and oxides will collect on contact surfaces—particularly when the switches are used infrequently. Opening and closing the switch in rapid succession will remove this surface covering. When copper blades and jaws are pitted, a fine file can be used to dress the surfaces to a smooth flat surface. Since abrasive cloths and papers contain non-conducting particles which may remain on the contact surfaces, their use should be discouraged.

4. **Pressure and alignment.** Pressure is more important than area, so switch blades should be lined up with jaws, and jaws should remain close together for a snug fit. Tension of spring washers at the hinge jaws should also be checked, insuring that blades move freely but not loosely.

5. **Fuses.** Fuses of proper capacity are essential to safety, so maintenance inspections should check for signs of overheating or the insertion of oversized links. Fuses, of necessity, occupy a hot position, for the largest portion of the heat generated in fused equipment comes from this point. Heat means oxidation, and oxidation results in more heat; a damaging cycle. So clean thoroughly: fuse contacts, ferrules, blades and links.

6. **Lubrication.** Wear and friction can be combated by proper lubrication with a light, sludge-free oil on pivoted connections and all operating parts. Petroleum jelly is best for sliding contacts. Excess oil should be avoided.

7. **Temperature.** Discoloration of copper parts and charring of fuse barrels are sure signs of overheating. Check, also, for signs of annealing, for this will cause fuse clips and switch jaws to lose their tension and will result in insufficient contact pressure.

Temperature should be checked not only at switches but on panelboards as well, for fuses or circuit breaker thermal elements function through the heating effects of the current carried

by them so, to insure proper operation, surrounding temperatures should be kept below 176 degrees F (80C). Cumulative heating from several heat-generating parts within a single enclosure can exceed this temperature limit. Convection currents from adjacent radiating devices can likewise raise the temperature. And, since heat rises within the enclosure, the top portion of an evenly loaded panelboard will be warmer than at the bottom. When temperatures rise above certain limits, fuses may blow or circuit breakers may trip on current loads less than the rated capacities of the units.

Controls

Control equipment is no exception to the rule that periodic inspection and maintenance is essential to service continuity for, if breakdowns are to be avoided, repairs and replacements must be anticipated and taken care of at the convenience of operating schedules and maintenance personnel.

Control equipment to be included in periodic inspections include magnet-operated devices such as relays, solenoids and contactors; thermally-operated devices such as thermostats; motor-operated devices such as timers, brakes and valves; and mechanically-operated devices such as master switches, pushbuttons, flow, float and pressure switches, drum controllers and manual starters. Static accessories such as resistors, rectifiers and capacitors also enter the control class, while arc chutes, flexible shunts, interlocks and gaskets likewise require attention.

Inspections should never be superficial. In the case of magnet-operated devices, the check-up should include control-circuit voltage, collections of gum and dirt, excessive heating of parts, the freedom of moving parts, the wearing surfaces and remaining thicknesses of contacts, excess slam on pickup, proper contact pressure, loose connections, condition of flexible shunts, condition of arc chutes or barriers, worn or broken mechanical parts, excessive arcing in operating circuits, condition and level of oil, condition of gaskets, excessive noise in ac magnets, evidence of dripping water or liquids falling on the control, condition of breaks or linings, the functioning of timing or sequencing of devices.

In the case of thermally-operated devices, these items should be augmented to include checking for corrosion of metal parts, excessive arcing in opening circuits, condition of heat-

ing elements and it should be ascertained whether contacts actually open when latching mechanisms are tripped. With motor-operated devices, maintenance men should also be on the lookout for excessive vibration or noise in operation, wear or roughness of sliding contacts, and the condition of gearing and general lubrication.

When considering arc chutes or barriers, if they are almost burned through, they should be replaced. This will prevent burned pole pieces and possible shorts. Flexible shunts can be tested by flexing or twisting to verify their flexibility.

And gaskets, if torn or damaged so that tight joints do not exist, should be replaced.

As a general rule, controls should be (1) tight, (2) clean, (3) dry, (4) kept free from oxidation, (5) kept free from roughness of contacts, (6) free-moving, (7) adjusted for firmness of contact pressure, (8) inspected for frayed shunts, (9) operating at rated voltage and (10) kept below critical temperature limits.

The theory of preventive maintenance is directly opposite to normal industrial repair procedures. For example, general trouble-shooting calls only mention the trouble. The repair electrician then traces the cause of the trouble and seeks a remedy for the cause. In the case of contact chatter, the cause might prove to be due to poor contact in the control pickup circuit, excessive jogging, a broken pole slider or slamming of the contactor, causing the interlock in the coil circuit to open. The remedy for this cause might be accomplished by improving the contact or using a holding interlock, finding whether the device is used for its intended purpose, replacing a worn or broken part, increasing the pressure on the interlock.

Preventive maintenance, by checking these last items, prevents the cause and trouble from developing.

Motors

Dirt, moisture, friction and vibration cause 90 percent of all motor failures. And oil—in the wrong places, uneven wear, misalignment and improper loading knocks out the other 10 percent. These causes, resulting in costly shutdowns, can be reduced drastically by following a program of preventive maintenance.

Consider the first item: dirt; just another word for "matter out of place." It can be black soot in a steel mill, white lint in a textile plant, grey filings in a machine shop or yellow sulphur in a chem lab. But white or

black—if it's out of place—it's *dirt*, capable of

- plugging vent holes,
- retarding cooling,
- glazing commutator brushes,
- scoring slip-rings,
- coating windings with unwanted insulation,
- creating shorts and grounded coils.

The Remedy?

Use enclosed motors where possible, keeping joints tight by frequent applications of elbow grease on the end of a wrench. Or, in the case of open motors, keeping bearings clean and oil filler caps closed, replacing worn dust seals and gaskets, regularly wiping motor housings, wound sections, slip-rings and commutators—using clean rags for the job rather than waste containing lint which will cling to oily surfaces.

Compressed air at about 40 psi. is recommended for blowing the windings. But keep the pressure below 50, or insulation may be loosened, permitting the dirt to slide *under* it. If blowing is impractical, use a *vacuum*; sucking up the dirt rather than blowing it back into the air. If motors still remain dirty due to the coagulation of dust, oil and grease, solvents are available that aren't too rough on insulating varnishes. In very stubborn cases, go to carbon tetrachloride. But remember that *carbon tet* fumes are dangerous, so observe safety rules concerning adequate ventilation and always beware of accidental sparks near the cleaning tank. However, if dust and dirt is removed *before* it forms a gum, solvents will be unnecessary.

Now for the second item; *moisture*—capable of softening windings, producing gum which will absorb fumes in the air and form destructive acids.

To fight this, open motors should be protected from drips and splashes; stand-by units should be briefly run every few days to guard against the accumulation of condensation during idle periods. And, when compressed air is used to blow motor windings, the air lines should first be tested to insure the absence of water in the hose.

When a Megger test indicates that insulation resistance has dropped due to the absorption of moisture, dry the motor at about 220 degrees F by any one of several methods.

An oven, when available, is excellent. However, insulation should never be baked to the point of brittleness and baking should be followed by a new coat of insulating varnish.

Another drying method is to lock the armature to prevent rotation, then applying low voltage current to the circuit. Insulation will be heated from the inside out, driving moisture from the windings.

Here's another way. Use hot air, placing a fan in a position to blow air through steam pipes or resistors into the windings.

Still another drying method is to cover the motor with a tarpaulin (except for vent spaces) and to place several incandescent lamps beneath it.

Remember also that air circulation aids evaporation. Like most of us on a summer vacation, motors are physically at their peak when working in a warm, dry breeze.

That third item, *friction*, can be retarded by proper oiling and greasing. Note the word *proper*. It should be applied strictly according to manufacturers' recommendations; using proper grades in the proper amounts at the proper intervals in the proper manner. For example: add oil only when the motor is inactive. This is important. For, with a motor in operation, shaft torque will cause lubricants to "ride the ring," thus giving a false indication of the amount of oil required. If too much oil is added it will subsequently be forced out, deteriorating mica insulating segments, coating commutator bars and soaking windings until things are really snafu.

Oil in the wrong places can be detected when the faces of brushes become glazed and dirty. Sparking will result and mica insulating segments between bars will deteriorate, and when windings become oil soaked, a break-down or burn-out is probably imminent.

When inside a motor, oil fights friction and wear. When outside, it is a hoodlum—catching dust the way molasses catches flies. So keep it where it belongs.

Next; *vibration*—shaking parts loose, breaking electrical connections, crystallizing metallic members and causing general wear.

This factor can be lessened by frequently checking motor alignment to see whether excessive bearing wear or foundation settlement has taken place. Mounting a motor on a shock pad will segregate vibration considerably; proper tension on belts and chains should be maintained, and motor mounting bolts should be kept tight.

If vibration develops immediately after a major repair job, check the motor for balance—dynamic if possible but static balance in any event.

Uneven wear on slip-rings and commutators is inevitable. But this condition can be minimized by regular wiping, keeping oil off the surface, using a commstone in a suitable holder, undercutting the mica and replacing worn brushes.

Misalignment (one of the more important causes for vibration) can result in burned bearings or broken shafts. Fortunately for the maintenance man, misalignment frequently gives warnings through temperature rise, increased vibration, or noise. For bearing or motor overloading will generally result in increased temperatures, uneven bedplates and excessive belt tension will set up definite vibration patterns, while the shoulder of a shaft, striking against a bearing, will frequently be revealed through rapid knocking.

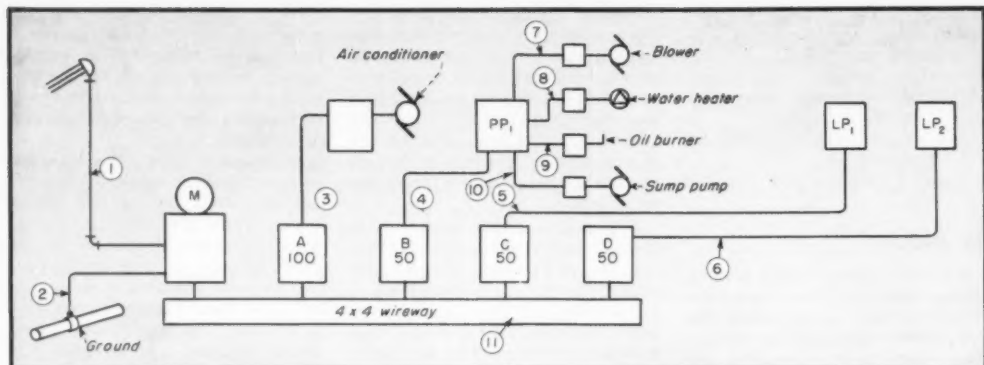
Improper loading, both overloading and underloading, should never be intentionally contemplated. The practice of manufacturers to rate their motors below breaking points should not be interpreted as an invitation to abuse the units. These margins of safety are provided only as a safeguard against the *unintentional* overloads caused through misapplication, by excessive friction, or temporary strains. For cheap protection against these conditions, use overload relays or fuses.

Underloading

Underloading isn't as serious, although it will pull your power factor down, resulting in higher line losses, higher voltage drop, decreased motor torque, increased utility load, higher energy costs, overheating of coils and general decreased motor efficiency. To correct: check the rated capacity and the load connected to each induction motor in the plant; relocate units so that energy is intelligently applied, and consider the use of synchronous condensers, synchronous motors and capacitors.

These precautions against dirt, moisture, friction and vibration constitute an important phase of *preventive maintenance* and add up to valuable industrial insurance. And, with the objective of reducing or postponing a lower percentage of motor failures, it's a policy worth considering.

Today, plant maintenance is vastly different from the old concept, where no action was taken until a machine actually stopped. There is no place for this type of operation, with resultant losses due to idle equipment and manpower. This leaves no alternative but to subscribe to carefully planned *preventive maintenance*.

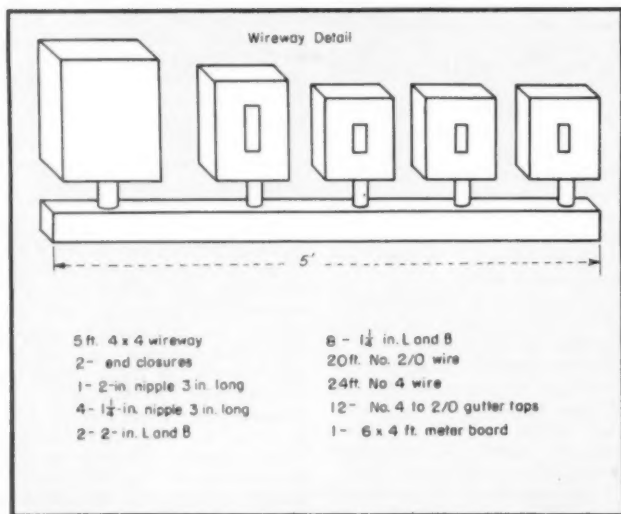


RISER DIAGRAM provides essential data for listing feeder and power circuit takeoff. Feeders are identified by number which keys the listings on the feeder schedule. Diagrams can be rough and need not be to scale.

How To Estimate Electrical Work—IV

- USE OF** the feeder diagrams to plan take-off.
- USE OF** the detail sketch to develop quantities.
- USE OF** the feeder schedule to list quantities.
- USE OF** the intermediate summary to accumulate like materials.

By W. T. Stuart



DETAIL SKETCH, roughly to scale, helps to visualize special features of the wiring system. The wiring details are readily listed from the sketch.

TAKE-OFF and listing of feeders and special circuits is essentially the translation of drawings and specifications into specific quantities of specific materials. If the original plans are not sufficiently detailed to provide for exact listing, the plans should be augmented by sketches and diagrams to clear up any uncertain areas.

On small installations, especially the routing and size of feeders, are often left to the contractor. In the accompanying example, a small store, the panelboards and equipment were described in the specifications and locations shown on the plans. The entrance equipment was also described but not detailed. The diagram and sketch shown are typical of the estimator's development of the plans and specifications to provide the necessary detail for exact listing.

A feeder or "riser" diagram is first prepared from the given material. An overhead service connects at a service head. A meter cabinet provided by the power company is installed on a wireway which carries the conductor to four breakers serving the air conditioning, power requirements and two lighting panels. The division of the lighting circuits over two panels on two main breakers is somewhat unusual, but represents a small scale application of the "dual distribution" principle, which has important advantages in retail stores.

The diagram is simple, yet provides

FEEDERS & POWER CIRCUITS

Feeder No.	From-To	Feet	No. of Wires	Size of Wires	Conduit	Ls	Bends	Term	Pull boxes, Fittings, Etc.
1	SE-meter	24	3	2/0	2	.....	.....	4	1—S. E. head & el Seal wall at entrance 4—1 hole straps and exp. shields in brick Ground strap
2	Meter-Grnd.	10	1	1	1	1	.....	2	
3	A—A. C.	28	3	4	1 1/4	4	1	4	
4	B—PPI	30	3	6	1 1/4	4	.....	2	
5	C—LPI	20	3	6	1 1/4	3	.....	2	
6	C—LP2	40	3	6	1 1/4	3	.....	2	
7	PPI—Blower	23	2	12	3/4	.....	.....	4	1-15 a. 2 p. breaker
8	PPI—W. H.	17	2	12	3/4	.....	.....	2	
9	PPI—O. B.	20	2	12	3/4	.....	.....	2	1-15 a. 1 p. breaker
10	PI—Sump	30	2	12	3/4	.....	.....	4	1-15 a. 1 p. breaker
11	Wireway	See detail							

specific data. Each feeder run is identified by number. The number corresponds with the listing on the take-off sheet. A useful point to note is that the lines indicating the runs should show how the run terminates at the panel, at the top, bottom or either side. As a diagram, it need not be to scale. The measurements are normally run off with a measuring wheel on the plans, with the ells, bends and terminals noted in relation to the structural details.

The arrangement of the service and distribution switches requires a further detail. This should be approximately to scale so that dimensional relationships can be seen. An "isometric" or three dimensional sketch is often useful here. Its purpose in the example is to determine the length of the wireway and the details of the connections. It will be noted that even a rough sketch may provide sufficient visualization of the work to give accurate quantities in the listing.

Feeders and power circuits are listed according to the feeder number. Conduit length in feet is measured and listed with the number and size of wires. Ells, bends and terminals are counted for each run. Fittings, pull boxes, fastenings, hangers or special conditions are noted. Prepared Feeder Schedule forms are always preferable for listing; however, columnar pads will serve.

The sketch of feeder and power circuits shown presents the data from the feeder diagram and the plans in specific quantities. Some of the items can be transferred directly to pricing sheets; however, an intermediate summary is required to accumulate the quantities in terms of conduit and

wire size and to make the necessary wire allowance for connections.

The intermediate summary brings like items together for total. As each item is transferred to the summary, it should be checked on the feeder schedule. All remaining unchecked items on the schedule are transferred directly to the pricing sheets.

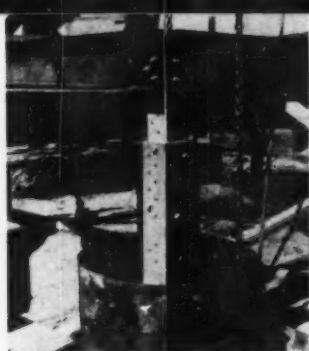
Wire allowances are entered on the summary (noted "a" in the example). For the example, the allowance for each feeder is entered separately for

the larger circuits and lumped in the smaller circuits. Estimators usually develop a "standard" allowance which they apply as a lump amount in the wire columns. The individual allowance, however, is more exact.

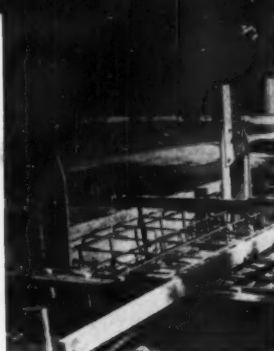
From the branch circuit schedule, the feeder schedule and the intermediate summary we have a set of quantities which represent the project in terms of its individual parts. These values entered on pricing sheets provide the take-off on quantity survey.

INTERMEDIATE SUMMARY

F	2'	L	B	T	2/0		F	1'	L	B	T	#1
1	24			4	72		2	10	1		2	10
					(a)15							a4
11					20		T	10	1		2	14
T	24			4	107		F	3/4			T	#12
							7	23			4	46
F	1 1/4	L	B	T		#4	#6	8	17		2	34
3	28	4	1	4		84		9	20		2	40
						(a)18		10	30		4	60
4	30	4		2			90					(a)40
							(a)12	90			12	220
5	20	3		2			60					
							(a)12					
6	40	3		2			120					
							(a)12					
T	118	14	1	10		102	306					



30-INCH CASING used during footing excavation through solidified soil was removed during placing of concrete.



PARTIALLY COMPLETED tower base, with concrete footing.

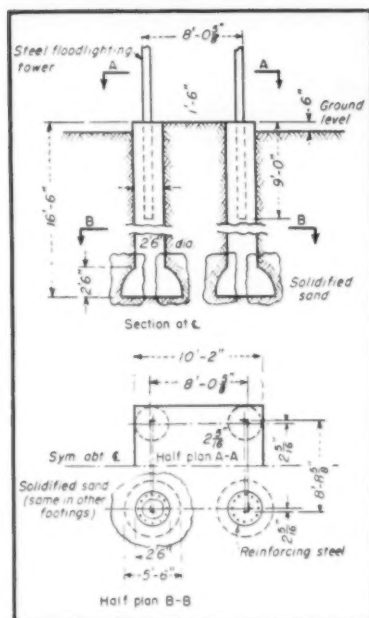
NEW TOWER

By Thomas G. Bristow

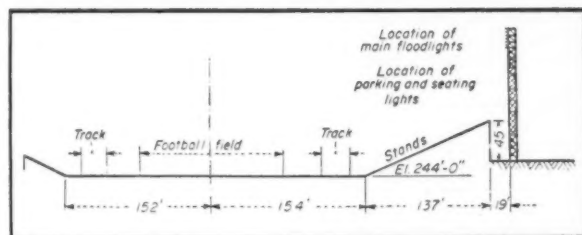
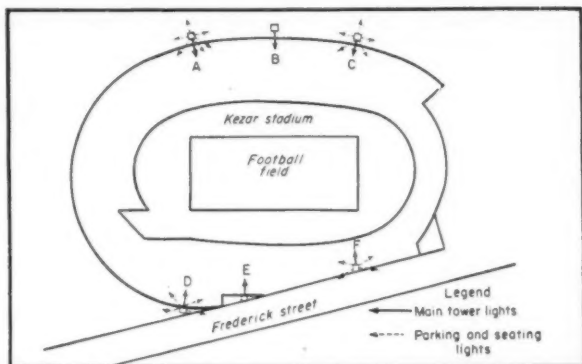
Electrical Engineer, Public Utilities Commission
Bureau of Light, Heat and Power, City of San Francisco
San Francisco, California

FLOODLIGHT TOWERS at San Francisco's new Kezar Stadium, installed on free-running sand fill, required new installation techniques.

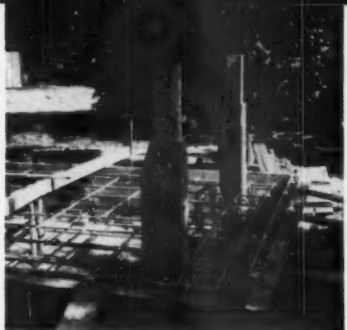
PLAN of Kezar Stadium, and location of six floodlight towers. Space limitations required Tower E to be located off-center, and Tower F inside stadium.



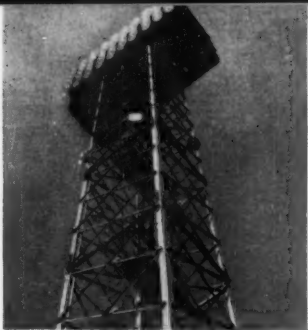
FOUNDATION for each tower consists of four bell-shaped reinforced concrete footings, installed in virgin sand solidified with sodium silicate. Conventional tunneling was unnecessary.



TYPICAL SECTION through Stadium shows relation of floodlight location on towers to football field, track and stands. Total of 350-1500w long-range narrow-beam floodlights light the sports area. All six towers are 136 feet high, designed to support 70 lights each.



ings poured and reinforcing steel in place for concrete foundation at grade level.



BANK OF 60 Type L-69 narrow beam General Electric floodlights on top of Tower C, with wide angle floods below.



ALL FLOODLIGHTS in each bank are easily accessible from tower platform for beam focusing, relamping, servicing.

INSTALLATION TECHNIQUE

Chemical solidification of foundation soil, to permit excavation of pier footings without shoring, was used for six 136-foot high floodlight towers at San Francisco's new football stadium.

INSTALLATION of floodlights last year at Kezar Stadium, a field built in close quarters and on free-running sand fill in San Francisco's Golden Gate Park, required use of a new construction technique—chemical solidification of the foundation soil.

A sodium silicate solution was pumped into the ground to permit excavation of bell-shaped pier footings without shoring, avoiding the extensive tunneling under sidewalks and stadium that would have been necessary with conventional methods.

A total of 350-1500-watt long range narrow beam floodlights mounted on six towers were used to light the field.

Chemical solidification was accomplished by introducing under 200 psi pressure 500 gallons of solution for each footing. The solution fills the voids in the soil, forms gels and cements together the loose grains for a period long enough to complete construction. The compressive strength of the solidified sand was about 75 psi. The 30-inch diameter opening was big enough to allow workmen to excavate the lower bell-shaped section by hand and also to allow for inspection of the bell after placing the reinforcing steel. A 30-inch casing, used during the footing excavation, was removed during the placing of concrete.

All six towers are identical, of the latticed steel type with bolted construc-

tion, 136 feet high, and designed to support 70 lights. Base dimensions are 8 ft.-8 in. by 8 ft. The towers are straight up to the 120-foot level. Between this level and the top, provision is made to mount seven rows of ten floodlights per row. Four platforms are located in this section, to support two lighting panels, a transformer, and to facilitate servicing the lights. Lights for the parking and seating areas are mounted at the 80-foot level.

Specifications called for a guarantee of an initial intensity of illumination equal to 60 footcandles horizontal, with a 40 percent maximum variation at any individual test station on the football field and 25 footcandles on the track. The footcandles average was to be obtained by averaging readings taken two feet above the ground on 10-yard centers and after ten burning hours. Actual tests of the installation showed an average of 63 footcandles on the field and 25 footcandles on the remaining area.

To obtain the desired illumination, the areas were laid out in 10-yard squares. Cards, identified by color and number corresponding to the tower lights were placed on the field according to an aiming diagram, and the lights were aimed at the cards.

A narrow beam floodlight of about 20-degree beam spread insured sufficient illumination for high kicked

DISTRIBUTION OF FLOODLIGHTS

Tower	Number of Floodlights for		
	Field*	Parking **	Seating**
A	60	3	3
B	48	...	...
C	60	3	2
D	60	2	2
E	48	...	...
F	48	2	2
Total	324	10	9

* Type L-69 General Electric Narrow beam floodlights.

** Type L-69 General Electric wide beam floodlights.

balls without resulting in an uncomfortable glare on the opposite stands.

The 324 floodlights used for lighting the football field and track operate at ten percent overvoltage, using 110-v lamps on a 120-v circuit and consuming 564 kw. The total lighting load is 700 kw.

The high voltage service consists of a 4-wire, 3-phase, 4160-v grounded star system. From the metal clad switchgear, located in the service and meter room, 2400-v single phase primary feeders extend to a 100-kva transformer located at the 120-foot level of

(Continued on page 165)

Wiring St. Mary's Academy

By Berlon C. Cooper

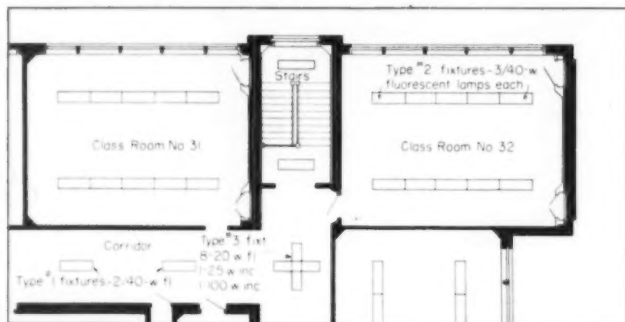


CRATED SWITCHBOARD for St. Mary's Academy, Bay View, E. Providence, R. I., weighing over 3000 lbs., was Air Expressed from factory in St. Louis.

Pawtucket, R. I. electrical contractor ships switchboard air express, and rushes wiring to completion on new East Providence school, to permit school reopening on schedule. Speed of delivery saved time, labor, money.



CORRIDOR LIGHTS combine normal and emergency lighting in same unit. EXIT sign has two incandescent lamps, one on the emergency circuit.



TYPICAL LIGHTING plan for classrooms, corridors and stair wells. Classrooms are lighted to 42 fc. average by two continuous rows of recessed 3/40-watt louvered units. Even diffusion eliminates shadows and glare.

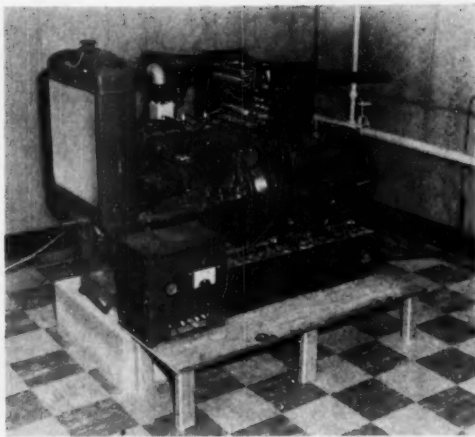
NEW England Machine and Electric Co., electrical contractors in Pawtucket, R. I., effectively aided in the completion of the school building for St. Mary's Academy, East Providence, Rhode Island, to meet a predetermined opening date. Making the deadline involved air shipment of a 3000-lb. switchboard. With only inches to spare, the crated three-panel board was loaded on a plane in St. Louis on January 20, arrived at the Hills Grove Airport outside Providence at 11:45 A.M. next day, and was trucked to the job and set in place ready to wire by 4:30 P.M. of the same day. Completion of the wiring by February 2, opening day for the school, was thus reduced to simple routine.

The additional cost of the air express, according to A. H. Sparr, Vice President of N. E. Machine and Electric Co., was more than offset by the cost which would have been involved in installing a temporary board and the additional overtime necessary to change over at a later date.

St. Mary's Academy, founded in 1874, opened its Diamond Jubilee during 1949. On February 5, 1948, fire razed the buildings which formed the physical plant of the school. Plans were immediately drawn for a new building to embrace both grammar and high school grades, by Samuel M. Morino, architect, and contracts let based on completion of the new building by February 2, 1949. The general contractor and all sub-contractors worked together to complete the new building within one year after the catastrophe, which permitted the school to reopen according to schedule, and



INSTALLED SWITCHBOARD, which serves entire electrical system at new school, was set in place ready for wiring same day it was received.



EMERGENCY LIGHTING system is supplied by 10 Kva., 115/230-volt generator, gasoline engine powered, located in switchboard room.

celebration of its Diamond Jubilee as planned.

The air-exposed switchboard is of the dead front safety type, and was furnished by Wurdack Electric Mfg. Company of St. Louis. It is supplied by 1200 amp. mains, with the main circuit breaker at top of left panel. The utility company meter is at the top of the center panel, and 14 outgoing feeders of various sizes, located on the three panels, are controlled by circuit breakers of varying sizes rated according to requirements.

Distribution

Primary service to the transformer vault is run underground from the overhead street service in 4-inch fibre duct buried 30 inches below grade in a concrete casement. Secondary service is of 3-phase, 4-wire 120/208-volt, 60-cycle characteristics. Feeders and branch circuits provide energy for light and power throughout the buildings. Power loads include a motor with 60 amp. safety switch for elevator, motors and controls for oil burners, ventilating fans, kitchen ventilating equipment, auditorium fans, laboratory equipment, etc. Lighting loads include lighting throughout the building, for entrance, corridors, classrooms, auditorium, gymnasium, offices, reception rooms, and all utility areas and grounds lighting.

Modern lighting is installed throughout the building, and includes both fluorescent and incandescent lighting equipment. The entrance lobby is lighted with recessed fluorescent troffers in two rectangular patterns, one within the other. The gymnasium

is lighted to 34 footcandle intensity average, using surface-installed 3/40-watt lamp fluorescent units equipped with heavy gauge louvers which serve as guards for the lamps. These units are installed in eight-foot lengths between beams in the ceiling construction.

The auditorium is lighted by recessed downlights in the ceiling, and by special fluorescent brackets having half-round glass diffusers and equipped with 40-watt amber lamps on the side walls. The stage is equipped with six 5-foot sections of disappearing footlights equipped with four colors, and provisions for future borderlights; also with stage floor pockets and receptacles. Aisle lights connected to auditorium seats are controlled by three circuits from the stage switchboard.

Classroom lighting is by means of recessed fluorescent continuous row louvered equipment. The typical layout consists of two 20-foot long continuous rows of 3/40-watt units spaced ten feet apart, which provides an average intensity of 40 footcandles of well diffused illumination.

Stage Lighting

A stage switchboard controls stage and auditorium lighting. It is a two panel board, free standing type, one panel for lighting control equipped with magnetic type circuit breakers, and the other panel for dimmers.

Corridor lighting is by means of recessed fluorescent individual units and recessed or surface-installed fluorescent and incandescent units for locations where "Exit" signs or emergency lighting are required. Special lumin-

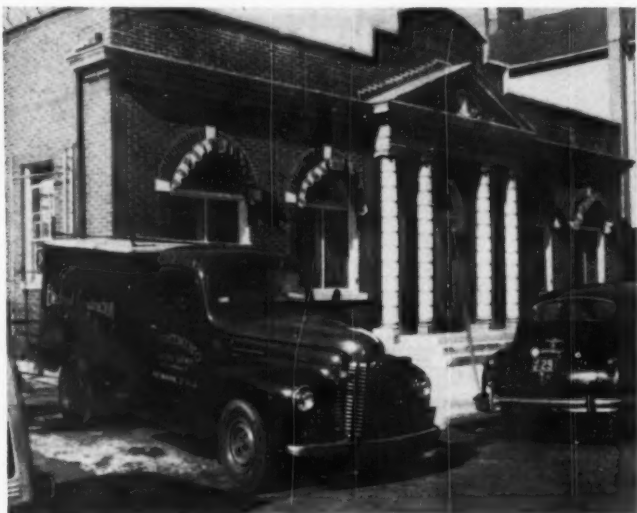
aires are used for this purpose, and are in the form of a cross, with the incandescent unit forming the center of the cross. Two sockets, one with 150-watt standard lamp wired to normal circuit, the other with 50-watt lamp wired on emergency circuit, are used above a 12-inch square prismatic glass lens, with four two-foot long fluorescent units, each using two 20-watt fluorescent lamps, flanking the incandescent center square.

Emergency lighting is provided by a 10 kva. gasoline generator set, which supplies 115/230-volt a-c power, controlled by automatic switchover arrangement when normal current fails.

Auxiliary Services

Other features include a self-regulating clock and program bell signal system, an automatic PBX 20-station and four-trunk telephone system, wiring for elevator, kitchen and special laboratory equipment, wiring for heating and ventilating system, fire alarm system, and sound system. The sound system will transmit two different programs to different rooms simultaneously, or general announcements to all speakers at one time. Programs may originate from the radio receiver, transcription record player, telephone line or microphones. The system also permits a conversation to be carried on between the principal's office where the control board is located, and any one room without interference with the two program channels.

Lighting equipment was supplied by Litecontrol, Century Lighting and Holophane. Stromberg-Carlson furnished the Sound System.



LIGHTNING Electric Service Company, attractively housed on a Newark side street, keeps nine trucks and 100 men working; does an annual \$1.5-million business.



ENGINEERING office, with multi-source light providing better than 250-footcandles

BLUEPRINT for CONSTRUCTION

Four factors contribute to the competent set-up of Lightning Electric Service:

- 1 Ability and team-work of personnel**
- 2 Application of modern methods, techniques**
- 3 Proper selection and maintenance of tools**
- 4 Ready availability of materials.**

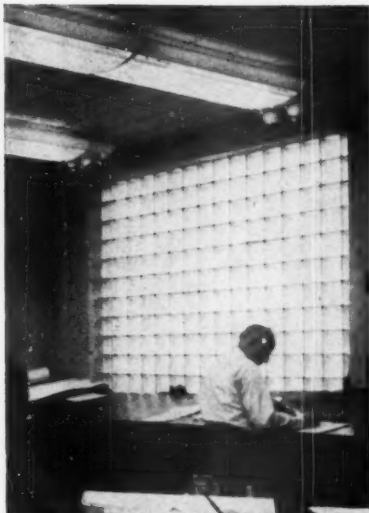
A SCORE of practical down-to-earth methods for office, shop, field and warehouse use are integrated into the organization of the Lightning Electric Service Company of Newark, N. J. And these methods are backed by the physical benefits derived from compact departmental floor plans, modern equipment, carefully selected and properly maintained tools, comprehensive stocks of materials and a fleet of trucks equipped for specific purposes.

Designed by and for electrical contractors, the engineering and business offices are compactly efficient, with provisions for fast and accurate drafting and blue-printing, ready reference to files of trade literature and estimating forms, inter-department communication and maximum comfort through the mediums of air conditioning, sound-proofing and high-level illumination. To facilitate the rapid take-off

of pencilled details from master drawings, a tilting glass-topped copying table, bottom-lighted by fluorescent lamps and equipped with a pantograph arm, is a positive aid. And the completeness of the equipment catalogue references, occupying 40 running feet of shelving, and conveniently located within easy reach of both purchasing agent and estimators, cannot be over-rated as a working tool. Included in this section are loose-leaf letter-sized ring binders, with useful data sheets and articles from trade publications protected by 8½-by-11-inch cellophane envelopes. Also conveniently located are comprehensive form files; including estimating sheets, NECA feeder schedules, conduit and wire summaries, recapitulation sheets, material take-off blanks, government permits (federal, state, county and city), and standard notices. These notices are generally in

4-copy pad form, with carbons interleaved to eliminate manual duplication of data.

Active plans and drawings are kept on hand in flat steel filing drawers; semi-active plans are rolled and kept in convenient cubby-hole cabinets for six months after the completion of projects and, after that time, the rolled plans are transferred to a fireproof warehouse for safe keeping. The status of all jobs in the planning or construction stages is recorded as an up-to-date visual reminder on a prominent chalkboard in the engineering department, with deadline dates for bids, deliveries and progress steps indicated. By referring to this board at frequent intervals, engineers, P-As and job foremen can intelligently budget their production, prompt their shipping channels, or allocate their equipment and construction personnel to best advantage.



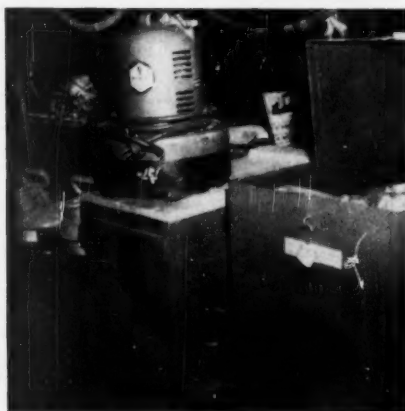
to desk tops, is provided with modern drafting and printing equipment.



REFERENCE library occupies 40 running feet of shelving; contains engineering data, manufacturers' catalogues and useful material clipped from trade magazines.



MAINTENANCE of tools and construction equipment is designed to promote safety on the job; improve operational efficiency; lengthen the useful life of these items; reduce manual effort required by men on the job.



ASSEMBLIES consisting of several parts are stored in containers distinctly numbered and painted orange and green to insure their identity.

Checking of information between departments is speeded by a 7-station intercom system which is combined with the normal telephone system and central switchboard.

Lighting takes advantage of natural daylight, fluorescent and incandescent sources, with two all-glass walls permitting light from both southern and northern skies to flood the engineering offices, and ceiling-mounted units providing additional artificial color-corrected high-intensity illumination for critical work. Louvered fluorescent fixtures include both 2-lamp 100-watt,

and 4-lamp 40-watt assemblies, while incandescent units are swivel-mounted 150-watt PAR floods. With all lighting in operation, intensities on drafting boards and estimating desks range from 195 to 253 footcandles. For normal conditions and requirements, i.e., with only fluorescent lighting in use, intensities on desks and tables average 110 footcandles.

"Completeness" is the word to describe the stock areas, for few items are missing from requirements of residential, commercial, industrial, highway and utility construction work, and

items range from tapes, cables, nuts and bolts to motors, controls, busduct and lighting fixtures. Quantities are not great in all cases yet they are sufficient to permit immediate construction on all types of electrical work without delays due to faulty shipping schedules or material shortages. Depending upon the volume, shape, weight and frequency with which items are required, stock is variously stored in drawers, bins, racks and shelves. All storage sections are plainly indicated, stock aisles are sufficiently wide to permit easy handling, and overhead



STORAGE areas contain complete variety of materials required for wide range of electrical projects. Bins, shelves, racks and drawers are plainly marked for identification.



ROLLING stock includes nine trucks variously equipped for light delivery, industrial and commercial work, highway and heavy line jobs. Extra trucks are rented as necessity arises.

cranes (up to 2-ton in capacity) facilitate the movement of heavy items to and from the shipping and loading areas.

"Completeness" also refers to equipment, with the list ranging from cutting oils, hoses and wrenches of all sizes to steel and aluminum scaffolding and field shanties which are knocked-down for easy handling and constructed on pre-fab principles for rapid assembly.

Tools for the Job

The variety of tools—manual, electrical and hydraulic—is particularly comprehensive, for pole diggers and derricks, stud welders and powder-driven guns, generators, drill presses, hydraulic benders, gasoline and diesel compressors, pumps, conduit pushers and cable pullers, electric conduit hacksaws and threaders are kept in stock and shipped out to all jobs even remotely suggesting the possibility of applying these tools providing mechanical advantages for the men in the field.

Instruments are likewise complete, with light-, wire-, ohm-, volt- and watt-meters (both case-contained and tong types), Meggers and industrial analyzers included.

Believing that a compromise with safety and efficiency is contrary to good business, the company maintains

all equipment in constant repair, with the maintenance work performed in the company's electrical, mechanical, machine and carpentry shops. In these shops—equipped with circular saws, drill presses, electric drills and grinders, spray and exhaust equipment—all equipment is checked and reconditioned as soon as it is returned from a project. Generator oil is changed, batteries are charged, cutting edges are sharpened, bearings and other worn parts are replaced, stuffing boxes are repacked and all moving parts are lubricated. All metal parts are wire brushed, primed with either red lead or aluminum, then (like all equipment, both metal and wood) given a final two-color finishing coat of contrasting orange and green paint. Not only is this coating distinctive but it quickly identifies company property on jobs where more than a single trade is employed and losses due to "misplaced or strayed" equipment have been eliminated. Where equipment consists of several knock-down sections or breakdown assembly parts, all parts are identically numbered and stored in correspondingly-numbered containers. This facilitates returning all components to their proper storage boxes and a handy check list inside each container quickly indicates whether or not an assembly is complete.

This maintenance program goes all-

out for safety, for worn ladder rungs are instantly replaced, ladders with splintered or badly worn side bars are destroyed, hoist chains with deformed hooks are scrapped, and broken insulation is cause for condemnation of the tool or equipment.

Maintenance Dividends

That this maintenance program produces tangible money-saving results is evidenced by the facts that accidents on the job have been sharply lessened, insurance rates have decreased correspondingly due to this improved safety record, and the savings in insurance premiums have gone a long way towards paying for the maintenance program. Not only does the company profit through reduced rates and reduced accident claims, but trained men are absent from the job fewer days, production efficiency is upped and prestige is enhanced.

This organizational and operational program—with employees working cooperatively in an environment designed for their comfort and convenience; with a comprehensive stock of tools and equipment on hand for all types of work, and with a planned maintenance program to keep equipment safe and in top working condition—is a clear blueprint for results-producing contracting. It is a blueprint for progressive construction.

Electric Radiant Heating—VI

Glass panels provide easily adaptable sources for partial or full electric heating.

GLASS heating panels provide electric radiant heating from compact and attractive sources operating at temperatures relatively higher than the ceiling type panels discussed in the previous articles in this series.

Glass panels are made up of heat-resistant clear glass with resistance grids of various types fused to the glass. Heat reflecting backing with sturdy framing and housing allows flush or surface installation in walls and the advantage of conventional wiring connections.

A large proportion of the energy delivered to the surroundings by the panel appear initially as radiant heat. In a typical panel design, the operating temperature is approximately 300 degrees. However, the conductivity of glass to heat is low while its transparency to radiant energy is high. The surface of the glass feels "hot", provides some connection by heating the adjacent air, but delivers most of its energy directly to the surrounding walls and furniture by radiation.

By raising the temperature of interior surfaces, the panels heat the air indirectly as a secondary result of heating "visible" surfaces. Just as with other radiant heating methods, the body receives the radiation directly and is consequently prevented from losing heat too rapidly.

It has been claimed for radiant heating systems that air temperatures can be reduced considerably over those normal to other heating systems with equivalent "comfort". While these conditions can be provided in a laboratory, it is, in the writer's opinion, not clearly established for ordinary surroundings and living conditions.

Whatever type of heating system is installed, it must have sufficient capacity to balance the heat loss at design temperature difference. To accept a lower interior wall and air temperature for radiant heating is to risk inadequate design. Much has been said about lower air temperatures, but with the minimum infiltration provided by good sealing and weatherstripping the air, walls and room surfaces tend to approach the same temperature. As we have said before in this series, the special characteristics of radiant heating offer a considerable field of study

in operating economies. From the standpoint of initial design, however, any system should have adequate heat input to balance maximum heat losses at any reasonable interior temperature the owners may select.

The design of heating systems using glass panels is substantially the same as the methods previously described in this series. Total heat loss and the heat loss of each area are calculated. Sufficient capacity is then allotted to each area for the design requirements. As with low temperature ceiling panels, it is preferable to exceed requirements. The kilowatt hours required by the system will follow the daily temperature difference between inside and outside temperatures through the automatic temperature control.

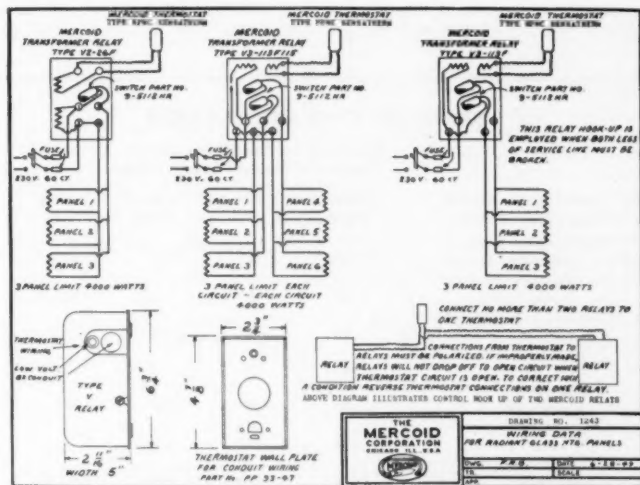
With electric radiant heating systems, very close control of temperature is highly desirable and practical in a way we do not find in other types of heating systems. First, the thermal capacity of the heating equipment is relatively low. There is a minimum of lag in starting and over-run in shutting down. Second, there are no mechanical or combustion elements in the system and the frequency of the on and

off cycle is unimportant.

One half degree temperature variation is below the threshold of temperature sensitivity of the average person. Practical controls and associated relays, however, can operate effectively on this small range. One such control system is illustrated in diagram here showing the Mercoid Sensatherm, relays and typical panel wiring connections.

Since each panel is a primary source of heat, i.e., electric energy is converted into useful heat directly at the point of use, panel heating systems are easily and logically zoned by individual room or area thermostats. In large rooms or areas more than one thermostat may be used. From the diagram it will be noted that one or two circuit relays may be employed to directly operate panel circuits up to 4000 watts per circuit. Relays may also be paralleled for operation from one thermostat.

The characteristics of electric radiant heating are such that a whole new field of heat control is opened up. It offers possibilities for precise temperature control and zoning heretofore impractical with combustion or central steam systems.



TYPICAL circuit diagram of controls and panel connections.

CARE OF INDUSTRIAL TUBES

High vacuum tubes are finding a place in many types of industrial apparatus. As oscillators, amplifiers and rectifiers, they perform many operations essential to efficient and economical production. An understanding of their makeup, functions and care is essential background for those responsible for their operation and maintenance.

By H. J. Dailey

Westinghouse Electric Corp.

Cathodes

The cathode is the heart of the oscillator, amplifier or rectifier tube, as it supplies free electrons to be utilized by the application of potentials to the various tube electrodes. Each of the three cathode types to be discussed is sturdy and dependable within its application limitations.

Oxide Coated Cathodes

Oxide coated cathodes are used in the greatest number of power and rectifier tubes where the principal requirement is economy of cathode power. The indirectly heated type is the most popular with the quick-heating filament type being a close second.

The oxide coated cathode is particularly susceptible to high velocity ion bombardment. Application of voltages to other electrodes *before* the cathode has reached proper operating temperature may cause complete or partial destruction of the cathode.

When the cathode is at its normal operating temperature, the electrons emitted by it form a cloud around the emitting surfaces. When other electrodes are energized by application of positive potentials, the passage of electrons from the cathode to these electrodes cause ionization of the molecules of the residual gasses.

Ions (those which have a positive charge) are accelerated toward the cathode as it is usually the most negative electrode. When the electron cloud exists the positive ions must pass through the cloud before striking the cathode. Many ions are neutralized, thus the ion current density at the cathode is lowered to the point where no permanent damage results. If voltages are applied to electrodes other than the cathode before this electron sheath or cloud is formed, there is nothing to prevent the positive ions from striking the cathode with the maximum velocity obtainable with the voltages applied. High velocity ions may cause stripping of the oxide coating from the cathode surface.

Operation at light loads with lower-than-rated minimum filament voltage

is sometimes permissible. The manufacturer specifies the conditions of operation including minimum heating time. The manufacturer should be consulted before any deviation is made from the published application information.

Tubes with this type of cathode usually operate at less than 1000 volts on the anode except in those types where the current density is very low or where the anode voltages are applied in short pulses. When pulse operation is permitted the maximum pulse duration is given by the manufacturer. Exceeding this value may ruin or permanently damage the cathode.

Overvoltage operation of the cathode causes volatilization of the barium, strontium and calcium oxides usually used in the emission mixture. Such volatilization causes coating of the grid or grids with emission mixture which may give rise to thermionic emission from the grid or grids, with the resultant changes in operating characteristics. The emission capabilities of a cathode deteriorate rapidly when operated above its optimum temperature.

Thoriated Tungsten Cathodes

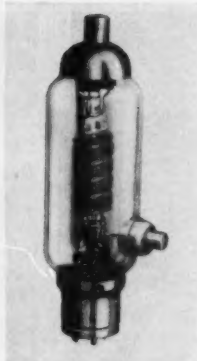
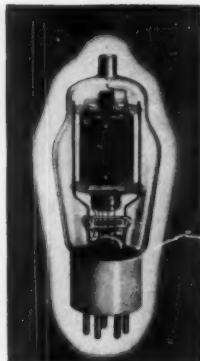
Thoriated tungsten filaments are used in small, medium and medium-large transmitting type tubes due to their relatively high emission efficiency as compared with pure tungsten. The emission efficiency is approximately ten to twenty times that of pure tungsten, but is approximately $\frac{1}{10}$ that of the oxide coated types. This filament type is susceptible to high velocity positive ion bombardment but to a lesser degree than the oxide coated type. This cathode is widely used in tube types of 2 kw power output or less but its use is gradually being expanded into the higher power field.

Loss of emission from this filament type occurs in three principal ways:

1. When the filament is operated below its voltage rating, the rate of thorium diffusion to the surface is re-

STAND-BY OPERATION TABLE

Tube Type by Kind of Filament or Cathode:	Recommended Stand-By Conditions (Per Cent of Normal Filament Voltage)			
	Under 15 Minutes:	15 Minutes to 2 Hours:	2 to 12 Hours:	Over 12 Hours:
Pure Tungsten Filament (Medium Types)	80	80	Off	Off
Pure Tungsten Filament (Large Types)	80	80	80	Off
Thoriated Tungsten Filament (Small and Medium Types)	80	Off	Off	Off
Thoriated Tungsten Filament (Large Types)	80	80	Off	Off
Oxide Coated Filament (Vacuum Types)	80	Off	Off	Off
Oxide Coated Cathodes (Vacuum Types)	100	80	Off	Off
Oxide Coated Cathodes (Gas Types)	100	100	100	Off



FORCED AIR-COOLED TRIODE with thoriated tungsten filament. It is used in induction and dielectric heating, FM, AM and television broadcasting (left). Radiation-cooled beam tetrode with oxide coated cathode (center). Radiation-cooled thoriated tungsten filament triode used in diathermy applications (right).

duced, thus the surface is gradually denuded of its thorium covering. Once the thorium coverage is less than approximately 80% of the total surface the electron emission decreases rapidly.

2. If the filament is operated above its rated voltage the rate of vaporization of thorium increases rapidly, and the layer of tungsten carbide decomposes rapidly with free carbon being released. When the filament surface is no longer tungsten carbide, or if the surface film of tungsten more than a few crystals thick, it again loses its high electron emission qualities.

3. When the filament is subjected to excessive high-velocity ion bombardment, the thorium layer is quickly removed from the surface and the filament loses its emission properties. Such failures may follow accidental overloads.

From these emission failure causes, two rules for thoriated tungsten filament operation may be written.

1. Always operate the tube within the ratings established by the manufacturer's recommendations.

2. If the tube is subjected to accidental overload, operate the tube with only the filament voltage applied at approximately 30% above normal for 30 minutes and reduce to rated voltage for several hours before again placing in service. This procedure should recondition the filament and help to restore the emission to or near its former level.

Thoriated tungsten filaments should be operated at their rated filament voltage, and in a circuit where voltage fluctuations are within plus or minus five per cent. Some manufacturers permit operating such filaments at less

than rated voltage (usually a maximum of 5%) when lightly loaded but the manufacturer should be consulted before so doing. It is often a wise precaution to operate the filament only at or slightly above rated voltage for 10 to 20 minutes before placing in service. This treatment applies to new tubes only.

Of the two tungsten types, i.e., pure or thoriated tungsten, the latter is more easily damaged by sudden physical shocks as tungsten carbide is hard and brittle. Insertion or removal from the socket should be carefully accomplished, placing padding against adjacent circuit parts to prevent striking the tube against a hard surface.

Thoriated tungsten filaments, being more fragile, usually require that the starting current be limited to a value of 150% or less of the rated current. The manufacturer supplies the maximum starting current for each type. A system of relays may be used to short out resistance in series with the filament transformer primary. A variable transformer, rheostat, or high reactance transformer may be utilized to limit the initial current surge to the required value.

Pure Tungsten Cathodes

This cathode type finds its principal application in power tubes and rectifiers which operate at high voltages and relatively high power levels. In the power tube types the cathode power required for reasonable tube life is usually low in comparison with the radio frequency power output.

The emission from a pure tungsten cathode is virtually independent of ion bombardment, thus is not easily damaged by accidental overload. High

voltage operation usually dictates the use of this filament type in high voltage rectifiers and larger power tubes. This type filament is often desirable for use where proper tube maintenance is difficult or wide variation of line voltage (greater than plus or minus 5%) are a common occurrence. Where multiphase cathodes are used the voltages between phases should be balanced with the voltage of each phase being held within the limits given by the manufacturer.

As the tube ages, mechanical shocks should be avoided. Mechanical shock to the filament may be introduced by means other than by bumping or dropping the tube. A sudden application of filament power from a well regulated voltage source to a cold tube causes a displacement of the filament strands from the magnetic fields set up by the high initial surge filament current.

It is desirable on the smaller tube types to limit the filament current to 200% of the rated current. This usually applies to tubes with rated filament currents of 100 amperes or less. For tungsten filaments requiring over 100 amperes for excitation the initial current should not exceed 150% of rated current, unless specified otherwise by the manufacturer.

The life of a pure tungsten filament is a function of its temperature, with life being extremely sensitive to filament voltage in the ranges normally used in filament design. For maximum life the filament voltage should be adjusted just above the minimum value required to supply sufficient electron emission for proper operation.

The rectified grid current is one of the most sensitive indicators of ample electron emission. When a pure tungsten filament three or four-electrode tube is being operated under load either as an oscillator or amplifier, the filament voltage may be reduced until the rectified grid current or the power output starts to decrease. The filament voltage should then be increased sufficiently to offset the normal line voltage variations. A readjustment once a month as outlined by this method would assure maximum filament life. If a pure tungsten filament is operated by direct current, the polarity should be reversed every 500 hours or once a month. For rectifiers, the anode dissipation is a good indicator of emission as it will increase rapidly as the filament voltage is decreased, thus may be used as an indicator of filament adjustment. Where radiation cooled rectifier tubes are used, the filament vol-

[Continued on page 166]



BRILLIANTLY LIGHTED ENTRANCE to Chandler's Shoes Store, State Street, Chicago. Intensities of from 300 to 2000 footcandles on merchandise displays, attracts attention of passers-by.



MAIN FLOOR as viewed from entrance, showing general store space in front and fitting and sales space beyond. All-glass front gives unobstructed view of entire first floor.

CASE STUDY IN LIGHTING

From 40 to 70 footcandles general and up to 300 on displays with $6\frac{1}{2}$ watts per square foot average in Chandler's Chicago loop store demonstrates planned lighting application.

APPPLICATION of modern lighting techniques for effective merchandising in Chandler's State Street store in Chicago offers an impressive case study in planned lighting installed by Continental Electrical Construction Company of Chicago.

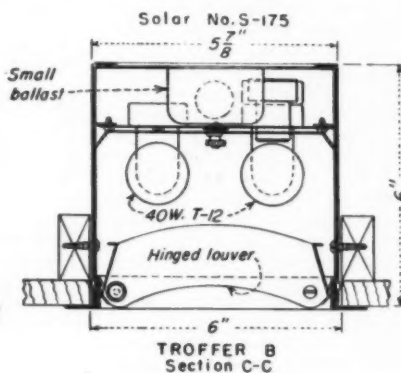
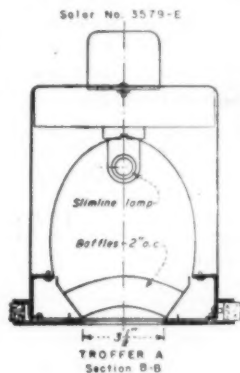
The entrance lobby is illuminated by eight incandescent projector flood lamps for general illumination plus five louvered projector spot lamps above the display. The windows are lighted by a row of 200-watt incandescent lamps in silver mirrored reflectors, slightly over one foot apart, supplemented by ten rows of slimline fluorescent lamps behind each louvered section in the ceiling, and by a row of 150-watt projector spot lamps in each louvered section to build up the illumination levels on the displays. These spot lamps are mounted flush and are adjustable. The average general lighting level in the windows is about 300 footcandles while the level on some displays was found to be as high as 2000 footcandles.

As illustrated above, a bag and hosiery display near the entrance is lighted with fluorescent. Incandescent downlights, behind diffusing glass,

supplement an arrangement of spot lamps and elliptical fluorescent troffers in providing general lighting for the store area. These are further supplemented at the point of sale at the bag counter by additional projector spot lamps. A fluorescent cove adds ceiling brightness to soften highlights in the display area.

The rear part of the main floor has a dropped ceiling lighted by 4-lamp slimline fluorescent troffers and recessed projector flood lamps. Shelf and circular niche displays are lighted with concealed fluorescent lamps. The back wall of white glass is trans-illuminated by slimline lamps. The conception and planning of the light-

FLUORESCENT TROFFERS provide general lighting and light for displays and circular wall niches. (A) elliptical troffer. (B) diffuse shallow troffer.





FITTING AND SALES SPACE, rear of above, reflects "sun-parlor" effect, created by white glass rear wall lighted from behind by slimline lamp strips. Luminous wall builds up general illumination.

FOR SHOE SALES

By Leonard V. James

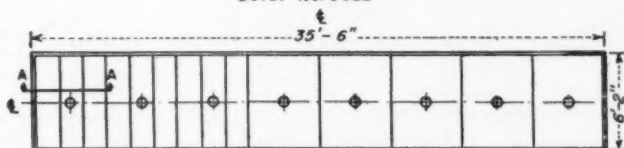
ing system in this case was the responsibility of the architects, Holabird, Root and Burgee of Chicago, assisted in the technical and merchandising aspects by W. Emil Foreman of St. Louis. Solar Light Manufacturing Company of Chicago made the equipment, much of it specially built for this store.

Some of the details of this store lighting installation are sufficiently unique and interesting to merit special description. Many are indicated on the plan drawing of the main floor.

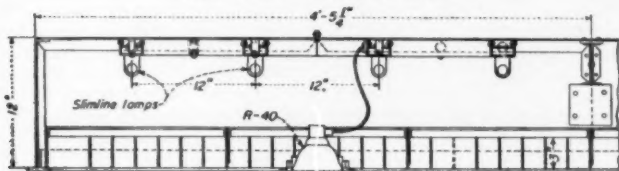
One unique detail is the ceiling installation of troffers and spots in the front of the store interior, which can be seen from the street. Because the

LOUVERALL CANOPY with adjustable spots used for accessory display on third floor is nearly 36 feet long, six feet wide, and formed from eight equal sections.

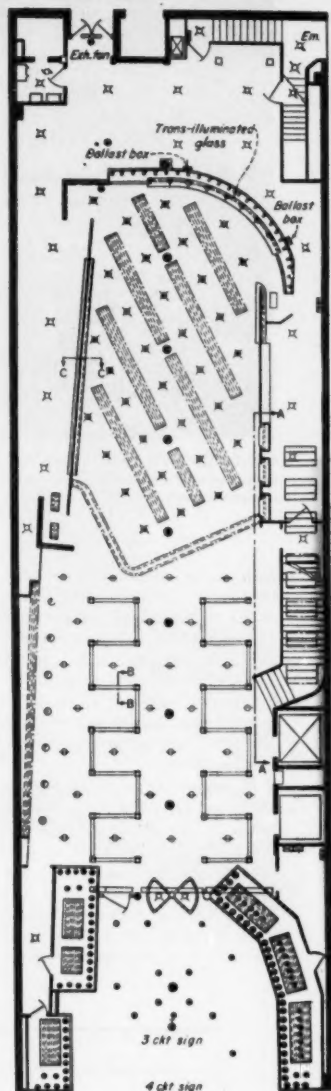
Solar No. 3622



PLAN OF COMPLETE UNIT



SECTION AT A-A



- Solar recessed flood and lamps (150 W.)
- ⊗ " " 150 W. No. 3537
- ⊙ " " 300 W. No. 2916
- ⊙ " " 150 W. No. 156
- Curtis recessed window reflectors (200 W.)
- ⊗ Ceiling outlet for utility lights
- ⊗ Exit light
- ⊗ Sign junction box
- ⊗ Recessed floor, fixt. or cove or displays
- ⊗ Comb. slimline and refl. spots
- ⊗ Vertical slimline strips

LIGHTING LAYOUT on main floor, showing integration of lighting with architectural details and merchandise displays. Fluorescent is used for general illumination and incandescent for high intensity and accent lighting. Combination of light sources provides good color quality.



FLUORESCENT LAMPS light the wall and floor cases, and is supplemented by overhead general lighting from recessed incandescent downlights, in French Room on second floor.



MODERN LIGHTING techniques used to light attractive accessory display on third floor feature this 36-foot long display, and include fluorescent lamps in the cases and above the canopy.

troffers are elliptical, they appear to be narrow luminous slots (3½ inches wide) in the ceiling, connecting from one bright spot light to another. Each troffer is equipped with one 64-inch T6 4500° 300 milli-ampere slimline fluorescent lamp. The maintained general illumination in this area, with all of the lighting on, is over 50 foot-candles average.

It should be noted that all of the slimline and standard fluorescent lamps in the store are 4500° lamps, the generally high level of illumination throughout making this color of light most acceptable.

The lighting of the shelf and circular wall niches and the bag display on the first floor is accomplished by the

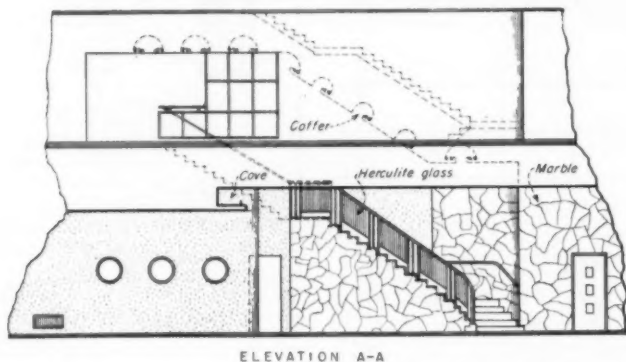
use of two or three-lamp troffers for T12 fluorescent lamps of suitable lengths. Three-lamp units are installed over the bag display and shelves and two-lamp units over the circular niches. Behind the round openings for these circular niches, which are 27 inches in diameter, there are 30 inch square boxes lighted with two 20-watt T12 lamps in each case. Maintained footcandles are from 50 to 200 on the shelves in the large bag display, 100 to 300 on the recessed shelf niches and 50 to 200 at the displays in the circular niches.

The coves across the center of the store, over the bag display and elsewhere about the store for the illumination of ceiling areas, contain two-lamp

strips and slimline lamps of lengths to fit the construction. These are placed close to the lip of the cove so as to avoid too bright a back wall. The function of the coves is to supplement the other lighting and more particularly to contribute to the general atmosphere and comfort by reducing brightness differences.

The accessory display on the third floor has a louverall canopy effect which, with its built-in supplementary equipment, accentuates the illumination of the accessories in the display and at the point of sale. The resulting lighting levels are 150 to 200 foot-candles. The louver section is approximately 6 feet wide and 36 feet long. Slimline fluorescent lamps 72 inches long are placed side by side, 12 inches on center, about 6 inches above the louvers. These louvers are constructed of baked white enameled steel, with 2 by 2 inch cells, 3 inches deep. Eight gimbel ring assemblies are inserted to accommodate 150-watt projector lamps—flood or spot can be used.

With such a wide variety of lighting treatments used in this modern shoe store, it is a tribute to excellent design, application and decoration that an atmosphere of complete harmony has been achieved. This is clearly illustrated by comparing the period chandeliers in the French room with such items as the louverall canopy over the third-floor accessory displays and the many variations of cove and niche installations throughout the store. Versatility of switching control provides numerous display combinations.



LIGHTED COFFERS provide an abundance of soft quality illumination for the stairway from main floor to the French Room above.



PERMANENTLY FORTIFIED
for Life-Time Wiring Protection

Unlike ordinary rigid steel conduit, SHERARDUCT is fortified—*permanently fortified*—against rust and corrosion by the Sherardizing Process of dry galvanizing. A pure zinc coating, driven into the pores of the steel, becomes an integral part of the tube itself because it's *alloyed with the steel*. Furthermore, SHERARDUCT will not split or peel, and although it can be bent easily, it will not crack!

SHERARDUCT is still further protected against acids and other corrosive agents by the clear "Shera-Solution" coating, baked on for added endurance. The smooth inside surface makes fishing easy.

Specify SHERARDUCT—full weight, threaded, rigid steel conduit—*fortified to give wiring life-time protection.*

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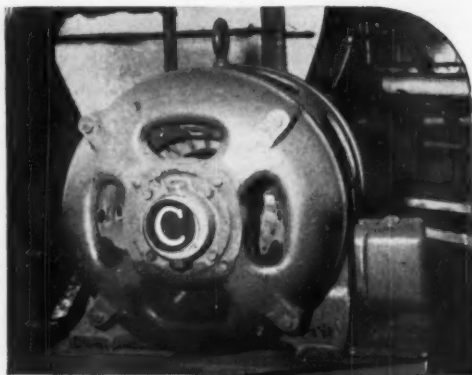
National Electric
PRODUCTS CORPORATION

1301 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

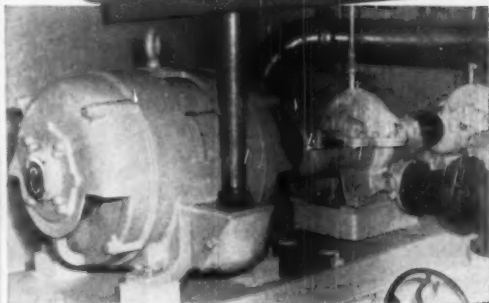


Century 40 horsepower, type SC motor driving an induced draft fan for a stack.

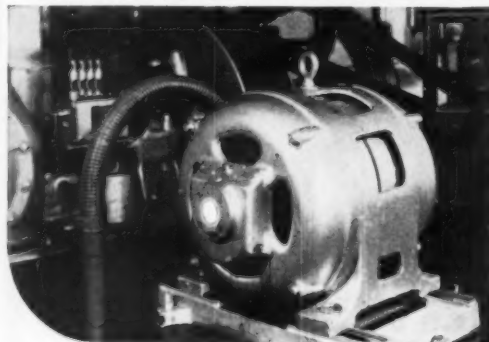
From *Century's* Line of Electric Motors You Can Select



- ① **Right Kind**—to match your current supply
- ② **Right Type**—to meet your load characteristics
- ③ **Right Protection**—against atmospheric hazards
- ④ **Right Size**—from 1/6 to 400 horsepower



Century 150 horsepower, type SC motor driving a two-stage centrifugal pump in a city water plant.



Two Century 75 horsepower SC high torque motors driving refrigeration compressors.

The wide range of kinds, types and sizes of Century motors makes it possible to select a standard motor to meet the requirements of all popular applications.

They are available for both AC and DC current—high, normal and low torque characteristics. Types are also available for applications requiring varying speeds and reversing direction of rotation.

To protect against atmospheric hazards, Century motors are enclosed in open rated drip proof, splashproof, totally enclosed fan cooled and explosion proof frames. Many types are available with vertical and flange mountings as well as standard horizontal bases.

Specify Century motors for all your electric power requirements.

Popular sizes and standard ratings are generally available from factory and branch office stocks.

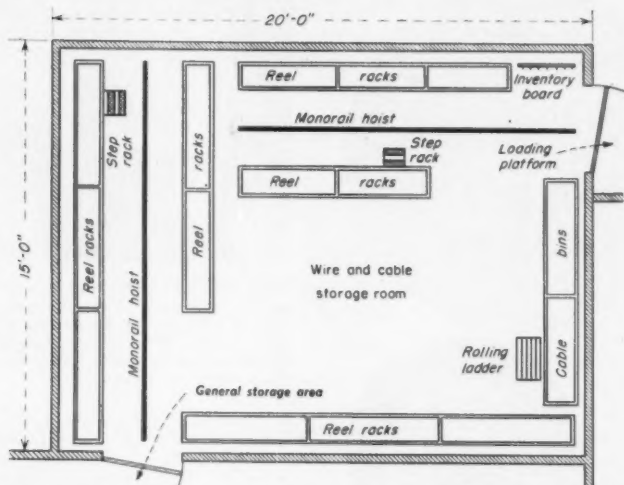


CENTURY ELECTRIC CO.

1806 Pine Street, Saint Louis 3, Missouri
Offices and Stock Points in Principal Cities

-624

Motor Shops



STURDY PIPE RACKS, extending up to 16-foot ceiling, support over 400 wire reels in 15-by-20 foot area. Rolling ladders, step racks and remote-control electric hoists facilitate raising and lowering of reels while inventory board keeps record of existing stock constantly accurate.

Space and Energy Conserved in Storage Room

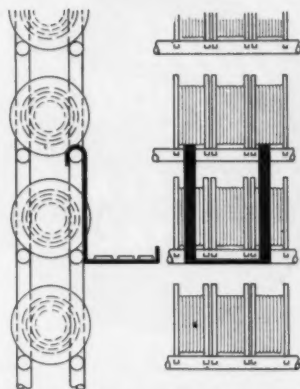
J. L. Hemphill and Company, North Bergen, N. J., stores more than 400 reels of wire and cable in an area covering only 300 square feet. This was dictated by limited floor space, but the result has many advantages and indicates what can be accomplished with proper rack design, remote-control electric hoists, rolling ladders and hanging reel cradles. Also of interest is their perpetual inventory board which gives existing cable stocks at all times. Jack Herman, Hemphill's efficient storeroom keeper, states that time, space and energy are conserved by these practical methods and devices.

As indicated in the floor plan, the wire and cable storage room measures 15-by-20 feet and racks extend upwards to the 16-foot ceiling. Racks are formed of 1½- and 2-inch pipe, welded together to form a sturdy, rigid frame. The reel-supporting horizontal members are spaced from 9- to 12-inches apart (depending upon the size of the reels to be cradled between them) and vertical intervals are 26 inches (for 2-foot reels), 19 inches (for 16-inch reels) and 15 inches (for 1-foot reels). With these dimensions, it is apparent that 7 tiers exist for the larger reels while the smaller spools are stored 13 high. This arrangement provides space

for 180 2-foot reels, 200 1-foot spools and 25 16-inch reels. Monorails are ceiling-mounted to serve the racks supporting the larger reels, while a rolling ladder (similar to those used in shoe and department stores) can be easily moved to reach any of the smaller and lighter reels.

When lifting or lowering a reel, the remote-control electric hoist is positioned on the monorail adjacent to the rack being considered. A leather belt sling is passed around the reel, and the hoist rapidly and safely performs the lifting chore. In the event that the reel is to be merely examined, or wire is to be removed from the reel without lowering the reel to the floor, the sling is used to lift the reel from its rack and swing it forward to rest on a hanging cradle or step rack. This step can be positioned as desired in front of any reel and it is supported by two vertical hooks that pass over the horizontal member above. Since the distance between the two vertical hooks is greater than the width of any reel, the reel can slide freely from its rack position through these supporting arms to the step where it can be safely examined at leisure without danger of having it drop.

A perpetual inventory is maintained



STEP RACK is positioned in front of reel to be removed from pipe cradle. Vertical hooks slide over horizontal member above reel and base of step rests against lower horizontal pipe. Since distance between vertical hooks is greater than width of reels, reels can pass freely between bars.



PIPE RACK is formed by 1½- and 2-inch members, welded together at all intersecting points. Horizontal and vertical distances between cradling pipes are 12 and 26 inches (for 2-foot reels), 9 and 15 inches (for 1-foot reels).

at all times, the inventory board being mounted in a corner of the storage room and the system consisting of large cardboard discs. The board is lettered alphabetically to coincide with the lettering of the racks, and series of hooks on the board correspond to the 400 reel positions in the storage room.

NEW

ARROW

**DUAL
PURPOSE
PORCELAIN
RECEPTACLES**

**FIT EITHER
3 1/4" or 4"
OUTLET
BOXES**

For fast, positive installation on either 3 1/4" or 4" outlet boxes, these new receptacles are tops. Open holes are provided for 4" mounting; knockouts for 3 1/4" applications. Styling is smart, modern. Oversized base, 4-11/16" in diameter, covers plaster irregularities around the box, making a neat, eye-appealing unit.

KEYLESS No. 111

Shown at right — Keyless Receptacle number 111. One-piece design. Handy angle contacts make quick installation easy. Added convenience: screws are staked — cannot fall out of unit.

PULL TYPE No. 7681

Shown at right — Pull Receptacle number 7681. Unit shown has chain and 3' cord. Other models are available with 7" chain or with chain and insulator.

Units of this type have removable porcelain rings which release the Bakelite pull interior for quick, easy wiring.

ALL RECEPTACLES ARE LISTED AS STANDARD by THE UNDERWRITERS' LABORATORIES, INC.

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**WIRING
DEVICES**

**ENCLOSED
SWITCHES**

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD, CONNECTICUT



JACK HERMAN, storeroom keeper, easily regulates position of heavy 24-inch wire reel by supporting it with leather sling and operating electric remote-control handle to activate overhead hoist.

Each cardboard disc (with a small round hole punched to fit over these hooks) carries a reel designation, the reel position, size of wire and type of insulation. Also listed is the gross and net weight of the reel when originally purchased and these weights are reduced each time wire or cable is removed from the reel. Therefore, by glancing at the discs hanging on the inventory board, the existing stock is quickly noted and, as soon as a certain size and type of wire is reduced to a minimum level, additional reels are placed on order.

Jack Herman, in charge of this storage room, is responsible for the condition of the stock, the inventory level and the records. The outside door to the loading platform is kept locked and, since the inside door opens directly into the general storage area where Mr. Herman keeps his records, the possibility of error due to stock being removed without reporting the withdrawal is slight. As a result, inventories are constantly exact and the area is maintained in a neat condition. Although the cable supply is comprehensive, the compactness and orderliness of the storage area gives the impression of uncluttered space.

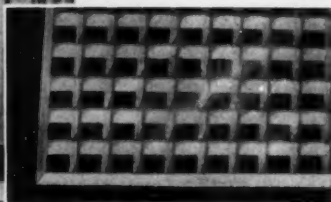
Outdoor Burnout Oven

A gas-fired outdoor oven is used to burn out stators at the motor repair department of the Barker-Fowler Electric Company, Lansing, Michigan. The circular oven is constructed of fire brick in a metal frame; is 48 inches in diameter and 36 inches high; has time-clock control of the gas valves and an



A NEW STANDARD OF LIGHT TRANSMISSION

Taste-Testing Room, Kraft Foods Company, Chicago, Illinois. Installation involved three types of recessed troffers made by Curtis Lighting, Inc. The three 40-watt lamp troffers provide an average of 40 F.C.; two lamp 29 F.C. and single lamp, 15 F.C. Recessed incandescent, 200-watt I.F. lamp troffer averages 66 F.C. Averages were calculated by using a coefficient of utilization of .41 and a maintenance factor of .75%. These values were verified by 21 actual readings after 100 hours of burning.



Close-up of FOTA-LITE showing how louvers penetrate full thickness of glass.

Like the Glow from the Northern Sky

Corning FOTA-LITE provides uniform brightness control from both fluorescent or incandescent light sources

In the taste-testing kitchen of Kraft Foods Company, foods are appraised and arranged for color photography and advertising art. A high level of illumination plus exceptional brightness control was desired. A combination of incandescent and fluorescent were found desirable for delicate color control.

To blend the external appearance of both luminaires and use the most efficient and effective material, Corning FOTA-LITE glass was selected. The choice of FOTA-LITE gave excellent footcandle and brightness values. Comparative brightness readings proved that FOTA-LITE produced lower values than louvered fixtures or several other types of glass panels in the 45° to horizontal zone. It brought out color contrast with clarity and reality.

FOTA-LITE is a remarkable new lighting glass. Diffusing louvers are transmitted into the full thickness of glass by a photographic process. They never lose efficiency for the image is permanent. Light directed vertically remains unrestricted while the diffusing louvers intercept and eliminate glare at the 45° cut-off.

FOTA-LITE permits dust-tight fixture construction. Maintenance is no problem since only a single flat surface need be cleaned. There is almost no limit to its application as it may be used in recessed or pendant lighting fixtures, continuous row or complete luminous ceilings. You can evaluate it best by sending for a sample. Use form below.



CORNING GLASS WORKS
CORNING, NEW YORK

Corning means research in Glass

FOR EFFICIENT, ATTRACTIVE LIGHTING...

CORNING ALBA-LITE for diffusion of fluorescent light... CORNING FOTA-LITE for high level illumination... CORNING brand LENS PANELS and PYREX brand LENS LITES for prismatic light control

FREE—FOTA-LITE sample on request.

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Please send me your FOTA-LITE demonstration card showing how FOTA-LITE diffuses and cuts off light at 45°

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FOR HAND PIPE TOOLS



RIGID Model "400" ...lightest power unit made

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RIGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL CO. • ELYRIA, OHIO



LOWERING A 75-hp, 1800 rpm, stator into the outdoor burnout oven at Barker-Fowler Electric Company in Lansing, Michigan. Electric hoist on monorail extends out from shop area.



COVER IS IN place on top of oven and gas turned on. High stack with automatic control provides proper combustion.

automatic stack control of its natural draft to shut off the gas if the oven becomes too hot.

An I-beam monorail supported by an electric hoist directly over the oven opening for loading and unloading. Stators up to 100 hp, 1200 rpm size can be handled by the oven.

Once the stator is lowered in the oven, a round, fire-brick lined cover is placed on the top of the unit. The cover is supported by a heavy pipe sleeve that swivel on a pipe upright. A long lever with an eccentric "foot" raises the cover on its supporting arm a sufficient distance to permit it to swing out of the way during loading and back into place after the oven is started. Ashes of the charred windings can be removed from an opening at the bottom of the circular oven.

Burnout time varies with the size of stator and condition of the insulation in the windings (wet, oil-soaked, etc.). Total time, including burning once the windings are ignited, is approximately 20 minutes for a five

MAKE SAVINGS WITH **C R E S C E N T** *ENDURITE Type RH*

*(Gives Greater Current Carrying
Capacity per Dollar of Installed Cost)*

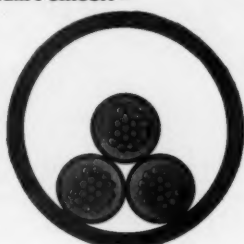
AN EXAMPLE-
200 AMP. CIRCUIT*



250,000 CM

TYPE R

Requires 2½" Conduit. Maximum permissible operating temperature 60°C.



3/0

TYPE RH

Requires 2" Conduit. Maximum permissible operating temperature 75°C.

The superior heat resistant characteristics of CRESCENT ENDURITE INSULATION with its higher permissible operating temperature and therefore greater current carrying capacity, permit the use of a smaller size of conductor, and in most cases smaller size of conduit at less cost than would be required for Type R Wire for the same load.

For light loads requiring small sized conductors, Voltage Drop is the determining factor in choice of wire size. Usually in sizes No. 6 AWG and heavier for power circuits or No. 1 AWG and heavier for lighting circuits, CRESCENT ENDURITE Type RH Wire & Cable gives the lowest installed cost-per-ampere of useful circuit capacity.

* In Accordance with 1947 National Electrical Code.

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WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.

TRENTON, N. J.



*This was the fire
that couldn't happen!*



THE CONSTRUCTION: FIREPROOF . . .
FIRE INSURANCE: MAXIMUM . . .

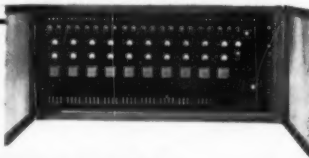
FIRE WARNING SYSTEM: **NONE.** And today smoke and charred ruins are the only remaining marks of a hospital that "couldn't burn."

Scenes like this are tragic proof that when it comes to fire, passive measures aren't enough. Fires are bound to happen — and your best safeguard is *positive* protection . . . check inspections 24 hours a day . . . a quick way of sounding an alarm . . . a sure method of getting help fast.

THAT'S WHERE COUCH FITS INTO YOUR PICTURE.

For Couch Fire Alarm Systems are on the job around the clock ready to help you avoid loss by getting action *quickly*. From among the many types that are made especially for hospitals, institutions and industrial plants, you're bound to find one right for your needs. Write today for Bulletin 116 for all details.

One of several types of Couch protective equipment . . . each fire and watch station transmits distinctive code signal which is recorded on paper tape along with hour and date . . . may be installed with a wide variety of signal alarms.



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Private telephones for home and office . . . hospital signaling systems . . . apartment house telephones and mail boxes . . . fire alarm systems for industrial plants and public buildings.

horsepower unit; 30 minutes for a 25 hp. motor; 40 minutes for motors from 50 to 100 hp. in size. The gas is actually on for about half of the total burnout time in each case.

Sheet and Roll Insulation Storage

Insulating materials are stored in one corner of the motor service shop of the L. R. Klose Electric Company at Kalamazoo, Michigan. To conserve floor space and still keep all materials within easy reach of the mechanic, Klose built a wood storage cabinet 92-inches high, 46-inches deep, and 39-inches wide. It contains 15 sections, each about 5-inches high. Some are the full 39-inch width; others have a



STORAGE CABINET for sheet insulation has 15 sections; each 46-in. by 39-in. by 5-in. high and equipped with hinged "drop" cover. Tubing is stored in trough shelves at left.

center division; all are the full 46-inch depth. Each section has a hinged "drop" cover held closed by two spring catches.

Stencilled on the front of each drop cover is the type and size of sheet insulation stored therein. Trough shelves on the "free" side of the cabinet contain various types of insulating tubing. A wall rack holds slot sticks.

Immediately in front of the cabinet is the insulation cutting table. Mounted to the wall-side of this table is a pipe rack containing removable spindles for rolled paper and cloth insulations. Arrangement is such that the insulation can be unrolled and fed into the cutter in one operation.

This arrangement confines all materials requiring the use of the cutter to a single area; speeds cutting operations; eliminates waste steps.



This is for Men with Restless Minds

You squirm and sweat until you've found and tried a new way of doing something—a better way. It's people with that kind of thoughts who have made the electrical industry conspicuous for its record of progress. They're still doing it.

Take, for instance, a field we happen to be interested in—insulated wire and cable.

Some of the shrewdest contractors in the business are using aluminum right now for feeders and other heavy cable installations. Why—when it takes effort to do something a new way? Simply because aluminum costs less.

Weighs less. Puts less strain on a building.

With a little extra effort, these contractors are getting credit for a good job at a lower price.

Do this yourself today: Figure one good feeder installation both ways—in aluminum and in copper. You'll see the reward for pioneering instincts.

For prices, call one of the manufacturers listed below.

For copy of "Questions & Answers About Aluminum Conductors", call your nearby Alcoa Sales Office, or write ALUMINUM COMPANY OF AMERICA, 1785D Gulf Bldg., Pittsburgh 19, Pa.



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Anaconda Wire & Cable Company
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 General Cable Corporation
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 United States Rubber Company

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PLYE-NATIONAL INDUSTRIAL LIGHTING FIXTURES



EXPLOSION-PROOF

PLYE-NATIONAL LE SERIES (Class I, Groups C and D)

For use in locations where highly flammable materials are manufactured or handled.

Rugged, flame-tight cast aluminum alloy housings render internal explosions harmless, and insure safe operating temperatures. Threaded construction permits easy access to interior for wiring and lamp replacement. Available in many types and sizes.

for safety

IN HAZARDOUS LOCATIONS



DUST-TIGHT

PLYE-NATIONAL DE SERIES: (Class II, Group E, F, G and Class III)

For use in locations where flammable dusts are present in quantity.

Strong, one-piece cast aluminum alloy housings are designed to exclude dust from the interior and to avoid accumulation of dust on the exterior surface. Available in many types and sizes.

FLEXIBLE SUPPORTS

PLYE-NATIONAL FO SERIES: (Class I, Group D; Class II, Groups E, F and G and Class III)

Pyle-O-Flex supports are for use with pendant type, explosion-proof and dust-tight lighting fixtures to comply with NEC which limits rigid stems to 12" in length.

Pyle-O-Flex is made to resist internal explosions and provides a good electrical joint without bonded jumpers.



Pyle-National also manufactures a complete line of explosion-proof and dust-tight supporting PYLETS for lighting fixture mounting, in addition to an extensive line of the most commonly used types of conduit fittings, switches and circuit breakers for hazardous locations. Consult the new PYLET Catalog

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P
SINCE 1897

Industrial Electrification

Speed Measurement

Chronometric, centrifugal and resonant-reed tachometers are essential tools for indicating and recording rotational speeds; providing useful data pertaining to slippage, stresses, load, lubrication, friction and power transmission.

By Stuart C. Sommer
James B. Biddle Company
Philadelphia, Pa.

Guesswork has no place in electrical operation. That applies to questions of frequencies and rotational speeds equally as much as it does to queries concerning voltage, amperage and power factor. For most modern production equipment is designed to operate at precise speeds and only by checking, interpreting and maintaining these rates can maximum efficiencies be obtained.

It is readily acknowledged by those associated with plant operation, production and maintenance, that speed is a vital factor in industrial operation. Yet too few fully appreciate the important facts that incorrect speeds are directly related to serious losses, and that speed fluctuations and variations are simple keys to problems relating to the mechanical transmission of power, lubrication, stresses and irregularities of load.

For these reasons, it is well to provide facilities for accurately measuring and recording speeds and frequencies. Periodic surveys can then be made with assurance, data can be assembled and intelligently evaluated, and indicated repairs or adjustments can be promptly effected.

Although with practice close approximations of speeds can be obtained by the use of revolution counters and stop watches, the application of modern speed measuring instruments improves both the simplicity and accuracy of readings. Such speed measuring devices include three major types of tachometers; the chronometric, centrifugal and resonant-reed types.

Profitable applications for tachometers in the electrical industry are as diversified as the industry itself, for they are necessary tools for testing the rotation of motors, generators, turbines, pumps, blowers, power tools and all equipments having rotating gears, shafts, spindles, vanes or pulleys. And accurate readings can determine belt

slippage, check cutting speeds and grinding rates, measure conveyor travel and detect friction. With speed and output so closely related, it follows that speed measurement can become a barometer of plant operating conditions.

Of the three types of tachometers mentioned, the first two—chronometric and centrifugal—fall into the class of instruments requiring an accessible shaft or other rotating or moving part for application and measuring. (Fig. 1) The third type—applying the theory of resonant-reeds—is also applicable when the shafts are not accessible, with speeds in rpm. determined simply by touching these types of tachometers to the machine being measured. (Fig. 2)

Where the need is for an instrument that will merely measure the average number of revolutions per minute, the chronometric type of indicator will suffice. As the name implies, the chronometric tachometer has a chronome-

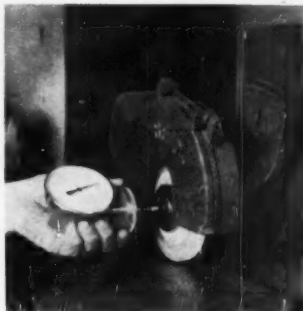


FIG. 1—Accessible shaft or other rotating part is necessary when speed is measured by a chronometric or centrifugal tachometer.

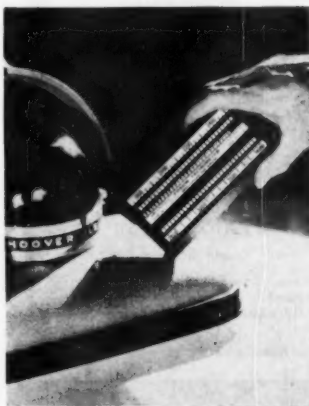


FIG. 2—Resonant reed tachometers indicate rotational speeds merely by bringing the instrument into contact with the machine.



FIG. 3—Chronometric tachometer has time-measuring element so that revolutions during a fixed period of time are recorded.

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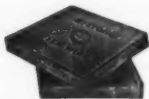
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FIG. 4—Centrifugal tachometer operates on fly-ball principle, directly indicating on the large easily-read dial face all variations in speed during the testing period.

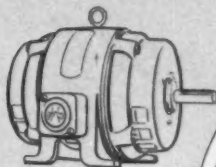
ter or time-measuring element, directly associated with it and it integrates, or adds, the number of turns or the distance of travel during a fixed period of time. Only average speeds are indicated. Instantaneous speeds and fluctuations are not shown. In use, a suitable tip is fitted to the instrument spindle and placed in contact with the centered end of the shaft. When a starting button is pressed and released, hands on the face of the instrument rotate for a few seconds, finally stopping at points indicating the required average shaft speed. By again pressing the button, the watch mechanism is rewound and the hands automatically return to the zero mark. (Fig. 3)

The centrifugal or fly-ball-governor type instruments are commonly known as indicating hand tachometers. They indicate directly, following closely all variations in speed for the period of the test. Units are available either as single-range or multiple-range instruments, with a gear changing device in the barrel. Since the pointer closely follows all changes in speed, slight variations will be apparent under conditions of belt slippage or load change. When measuring shaft speed, the rotatable head is set for the correct speed range. However, if the speed is not known, the mechanism is protected from damage due to overspeeding by starting with the highest range on the instrument. If the pointer does not respond when the tip is placed against the rotating element, the next lower range is selected, with this process being repeated until a satisfactory reading is obtained. When feet-per-minute are being measured, a rubber-tired wheel is substituted for the spindle tip and is held firmly against the surface

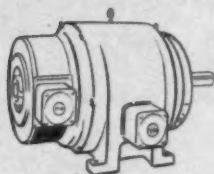
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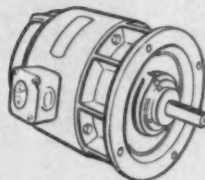
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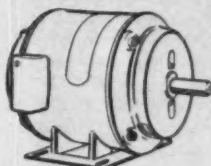
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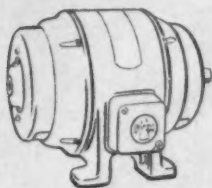
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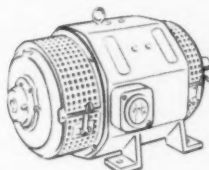
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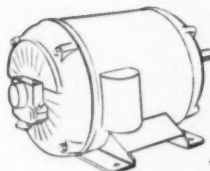
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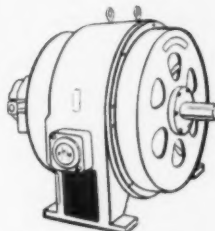
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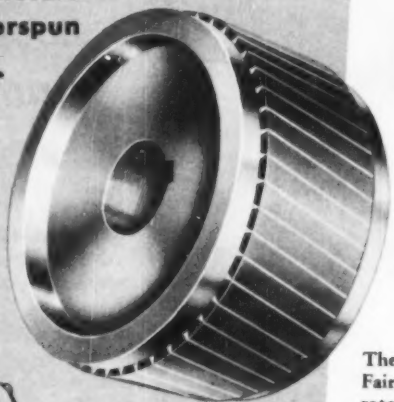
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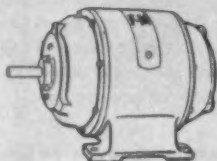
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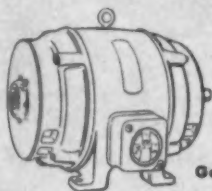
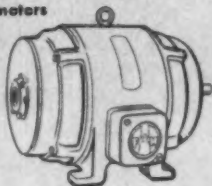


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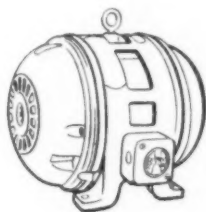
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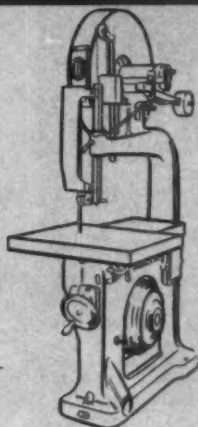
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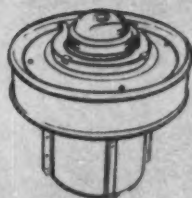
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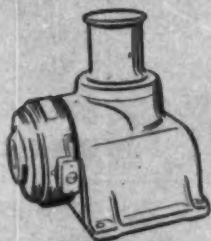


BAND SAW. An Axial Air-Gap motor cuts down on width and smooths operation of this new wood-working machine.



VENTILATOR FAN. Note how an Axial Air-Gap motor reduces height and simplifies fabrication of this ventilating fan.

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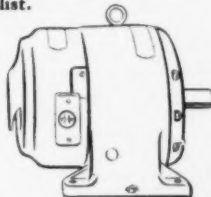
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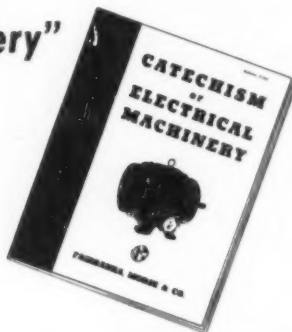


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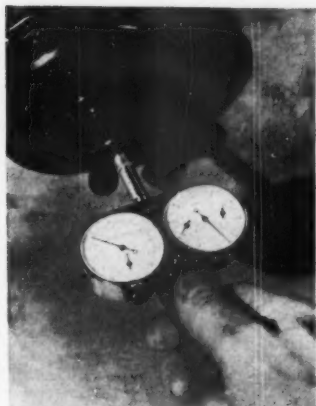


FIG. 5—Tachoscope combines a stop watch and chronometric speed counter with all hands operating clockwise regardless of rotational direction of shaft on motor.

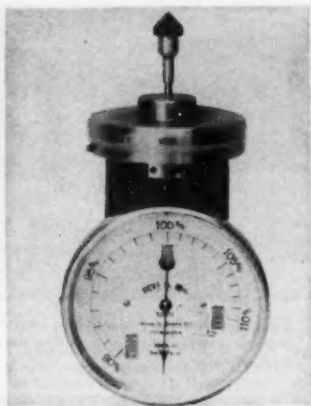


FIG. 6—Tachonorm measures speeds as percentages of normal. Extreme accuracy of instrument makes it valuable for research and laboratory work.

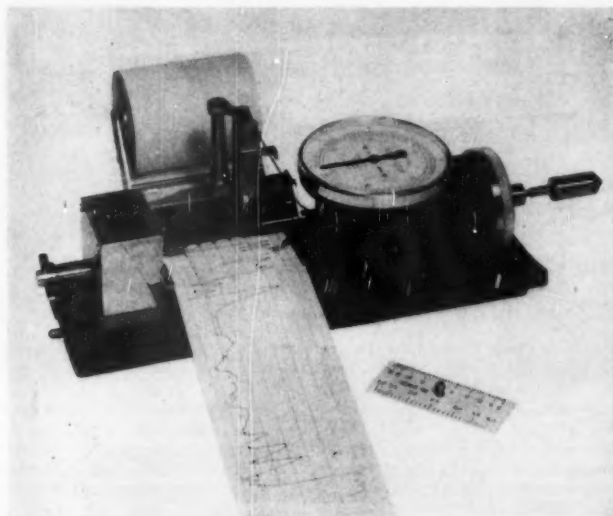


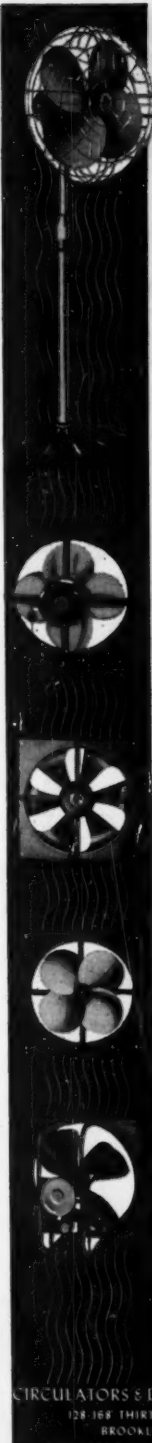
FIG. 7—Tachograph traces a permanent record of speeds or rates of travel on a roll of graph paper which moves forward at a constant rate.

of the belt or pulley being tested. (Fig. 4)

The basic principles of the chronometric and centrifugal tachometers are also used in three additional instruments which we call the tachoscope, tachonorm and tachograph.

The tachoscope is a combination stop watch and chronometric speed counter with time and motion automatically integrated. Since the human element is eliminated, errors are extremely rare and high accuracy is maintained. For this reason, many engineers use the tachoscope as a primary

standard for speed measurements. On the watch face, a large hand revolves once a minute in 1/5th-second intervals while a smaller pointer revolves once every 30 minutes. The revolution counter has three dials; with the large hand indicating rpm. from 0 to 100, one of the smaller dials indicating revolutions up to 1000 in intervals of 100 rpm., and the other smaller dial indicating revolutions up to 10,000 in 1000-rpm. intervals. All hands operate clockwise regardless of direction of the rotating spindle, so readings are rapid and accurately readable to 0.5



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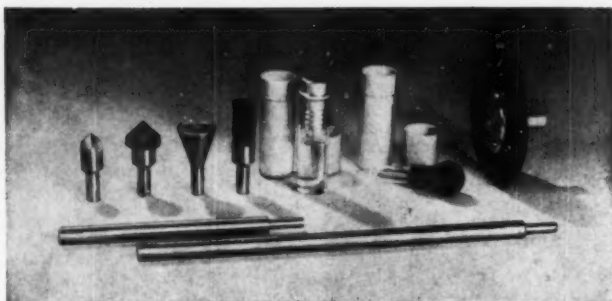


FIG. 8—Accessory parts for chronometric and centrifugal tachometers include extension shafts and a variety of metal and rubber tips, cones and wheels.

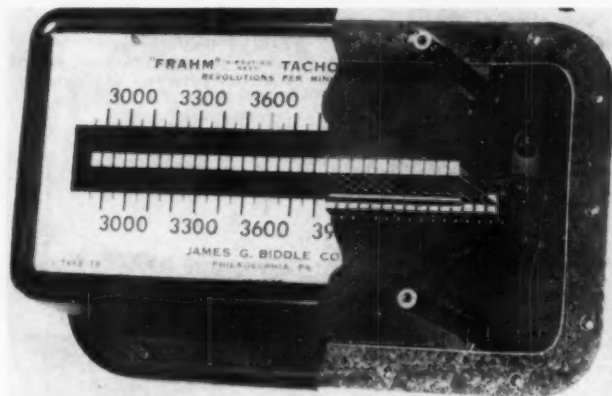


FIG. 9—Cutaway view of splash-proof rectangular type Frahm Tachometer shows simple construction of resonant reed instrument.

revolution. Since longer intervals are less affected by slight errors than brief ones, readings are taken usually after 30- or 60-second periods. (Fig. 5)

The tachonorm is generally confined to research and laboratory work, where speeds must be measured as a percentage of normal speed with extreme accuracy. One of the most important applications of this instrument is setting speed limit devices on rotating machines of all types, such as turbines, motors and equipment intended to function closely within specified limits, as well as for setting over-speed trips on governors where a machine must be taken out of service at a certain percentage over normal speed. As many as 6 normal speeds can be included in one instrument, and the range can be as much as 20 percent above and below normal speeds. Because the scale is relatively long for the speed range it covers, and because it is a direct-reading instrument, accuracy of readings is assured. (Fig. 6)

When it is desired to record the

actual speed performance of equipment being tested, the tachograph or curve-drawing tachometer is available and a permanent record is traced by the unit on graph paper. (Fig. 7)

To facilitate the use of chronometric and centrifugal tachometers, accessory extension bars, triangular steel tips, rubber points, muffs and wheels can be obtained with these instruments. (Fig. 8)

The third major type of tachometer—the resonant-reed or vibrating type—is available for both hand use or for permanent mounting. These units are unique in their abilities for measuring speeds and vibration rates simply by contact with the machines being tested, requiring no direct contact with rotating elements. Therefore, where no moving parts are accessible, this feature permits the taking of readings which might otherwise be difficult or impossible to obtain.

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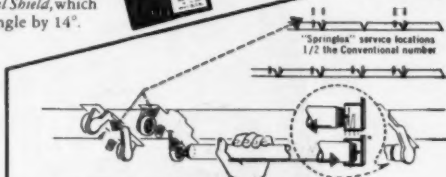
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Benjamin "Stream-Flo 40" Diffuser Units Porcelain Enameled Units with Apertures directing part of the light upward.

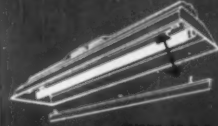
Benjamin "Stream-Flo 40" Recessed Mounting Units. Porcelain Enameled Units Approved for Recessed Mounting by Underwriters' Laboratories, Inc.

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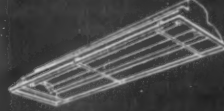
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Benjamin RLM "Twin-Flo 40" and "Triple-Flo 40" Units. Porcelain Enameled Open-End Units for two and three 40-w Fluorescent Lamps.

"Twin-Flo 40" and "Triple-Flo 40" Diffusers Porcelain Enameled, Open-End Units with Apertures directing part of the light upward.

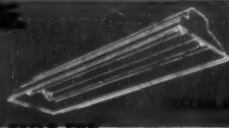
SYSTEMS 9 & 1



SYSTEM 4

VAPOR-TIGHT

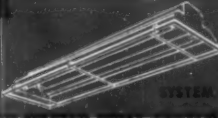
Benjamin "Vapor-Tite 40" Lighting Units with Sealed, One-Piece Porcelain Enameled Housing and hinged Glass Cover. Approved as Vapor-Tight by Underwriters' Laboratories, Inc.



SYSTEM 6

DUST-TIGHT

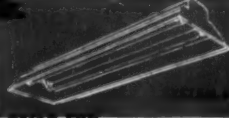
Type 11-B "Sealed-Flo 40" Dust-Tight Units Porcelain Enameled, One-Piece Units with Glass Cover—Approved as Dust-Tight by Underwriters' Laboratories, Inc.



SYSTEM 6

MOISTURE-PROOF

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SYSTEM 6

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electrical connections are unnecessary. For practical purposes, the instrument is unaffected by ordinary temperature changes, stray magnetic fields or operating positions. It is rugged without being sluggish; accurate but not complicated; sensitive but not delicate. With no direct connections between meter and machine, there is no danger of overspeed. It will therefore stand a lot more use—and abuse—than most tachometers and, due to its simplicity, it can be used with accuracy by operators with little or no previous experience.

Tuned reeds are mounted in a comb-like pattern on a reed shoe and scale calibrations are marked on the face of the instrument. When held against a machine in operation, the individual reeds in tune with the vibration of the machine will respond by forming a visible pattern on the scale which is directly read in revolutions per minute. Accuracies better than 0.5 percent can be achieved, with ranges going as high as 100,000 rpm. In fact, a recent test by the National Bureau of Standards on a normal 60-cycle Frahm Frequency Meter (taken at random from stock) indicated an accuracy within 2 percent. (Fig. 9)

The theory of resonance is well known through our acquaintance with radio and tones produced from musical instruments. When a reed is in resonance, slight vibrations are visibly amplified so that, although the base moves but slightly, the tip swings through a relatively wide arc. Since no rotating machine is absolutely free from vibration, contact between meter and machine will always produce a definite pattern on the scale.

Since it would be impractical to construct a meter having a reed tuned for each possible revolutionary vibration, the interval between reeds becomes a

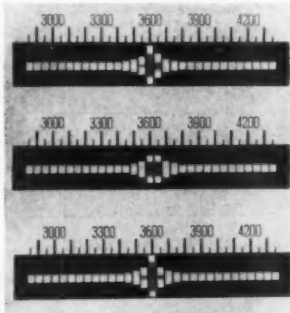


FIG. 10—Visible pattern of vibrating reeds gives rapid and accurate approximation of speeds. Patterns shown above indicate speeds of 3600, 3625 and 3612 rpm. (Top to bottom).



FIG. 11—Frequency meters are similar to resonant reed tachometers in construction and principle, with electromagnet vibrators transmitting circuit frequencies to visible reeds.

compromise between range and accuracy. A 3600-rpm. reed, for example, is tuned to within about 11 rpm. However, with practice, readings can be made quickly and easily to one-quarter of this interval. To illustrate: when the amplitude of one reed is at its maximum and the amplitude of those on either side are smaller and equal, the speed of the machine is equal to the speed of the reed vibrating at maximum amplitude. When two successive reeds vibrate with equal amplitude, the speed is half way between the tuned frequencies of these reeds. And when one reed vibrates at relatively large amplitude and the amplitude of adjacent reeds are unequal, the speed is determined by interpolation. (Fig. 10)

So nearly alike are resonant-reed frequency meters to resonant-reed tachometers in construction and principle that a few words are included to emphasize their simplicity and efficiency. When connected directly across the circuit, like a voltmeter, the frequency of the circuit is transmitted to the reeds by means of a small electromagnetic vibrator and, by noting the pattern of vibration and interpolating in the same manner as for the resonant-reed tachometer, readings are possible within one-eighth of a cycle. (Fig. 11)

Inasmuch as regular plant-wide inspection of power and driven equipment is vital to efficient operation and profitable production, and since the intelligent interpretation of data depends upon the accuracy and completeness of records, too much emphasis cannot be placed upon the inclusion of speed measurements obtained with accuracy through the use of tachometers.



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EVERYTHING

THIS BOOKLET tells all about the new Federal Noark Front-Operated Safety Switch . . . shows why it's the safest safety switch ever built . . . the coolest in operation . . . the easiest to install and maintain . . . the most profitable safety switch for you because it's the best safety switch for your customers.

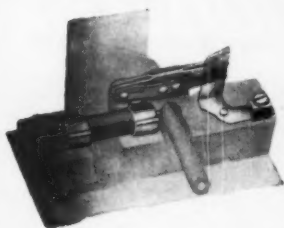
From pictures and descriptions, you'll learn about the guaranteed current break of this new switch; its visible blade construction and special 3-position, front-operated handle. You'll see how safety is further assured by arc mufflers or Rolarc snuffers that extinguish arcs instantly . . . how accommodation for four locks makes the switch virtually tamper-proof.

Other pages tell you how the new Noark design permits removal of blades and mufflers in a jiffy . . . how the entire switch mechanism is easily removed from the enclosure . . .

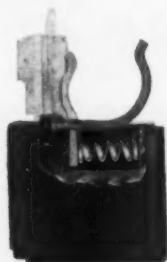
how unit pole construction (each pole on an individual block) cuts losses due to accidental breakage.

And here's the whole story of how *coolest* operation has been attained. Loose joints cause heat, and this new switch has *only two joints* to each pole (some switches have as many as six). These joints are held under extreme tension by powerful steel springs. An ingenious one-piece fuse terminal and lug construction, and a new patented high pressure fuse holder are other features that bring low operating temperatures and long service life.

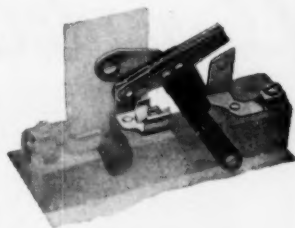
New Federal Noark Front-Operated Type "A" Safety Switches come in 30, 60, and 100 ampere capacities, for 230-volt A.C.—250-volt D.C. and 575-volt A.C.—600-volt D.C. Type "C" Front-Operated Safety Switches come in the same sizes and have many of these special features. Mail coupon on next page for your copy of booklet.



1 For coolest operation, the new Noark Safety Switch has only two joints to each pole and they are both under high tension. Heavy external steel springs along the switch blade apply constant pressure at both hinge and breakjaw.



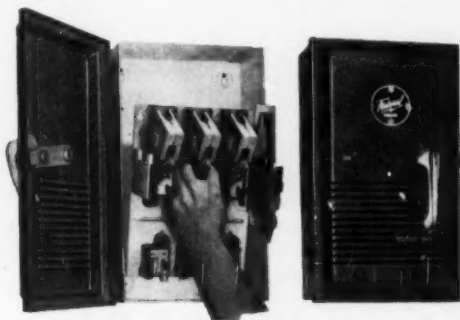
2 Pressure spring of the patented fuse holder is located in block under fuse where unaffected by heat. High-pressure lever action assures minimum contact resistance: cool operation. No screws to work loose; no springs wear fuse to become annealed.



3 This is the only visible blade switch with the operating cross bar *beneath* the switch blades. The operator is thus safeguarded because the cross bar forces open the contacting blades regardless of broken hooks or damaged hinge mechanism.



4 New Federal Noark Front-Operated Safety Switches of more than 250 volts are protected by Noark Rolare Snuffers. These operate by means of two arc-resistant rollers which snap together when switchblades leave the breakjaw and extinguish arcs instantly.



5 Entire switch mechanism is mounted on a back plate which can be removed from the box by loosening three self-retaining screws. Wiring is quick and easy. Blades and mufflers can be removed in a few seconds. Individual pole blocks cut losses due to accidental breakage. As these new Safety Switches are operated from the front, they can be closely banked for maximum space saving.

6 Federal Electric has spared no expense in making the new Noark Front-Operated Safety Switch smart and attractive in appearance as well as mechanically perfect. Enclosures are of code grade steel, finished with gray baked enamel . . . Each switch carries Underwriters' Laboratories approval and has the maximum horsepower rating for its size allowed by the Underwriters.

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Harry Norris, Contractor

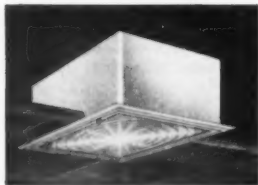


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Modern Lighting



RECESSED FLUORESCENT UNITS and incandescent downlights provide 60 footcandles of general illumination to clothing displayed by B. R. Baker's Clothing Store in Cleveland, Ohio. Cove lighting over wall racks and above elevator canopy minimizes ceiling brightness ratio while PAR-38s highlight special displays.

Lighting Promotes Clothing Sales

Recently installed lighting in the Men's Clothing Store of the B. R. Baker Company in Cleveland combines several approved illuminating techniques and utilizes both incandescent and fluorescent lamps to highlight the clothing, uncut fabric and leather goods on display.

Primary lighting is ceiling recessed and provides better than 60 footcandles on racks and counters. Fluorescent equipment consists of 4-lamp 40-watt troffers designed by Robert T. Dorsey of the General Electric Company and manufactured by the Crescent Metal Products Company of Cleveland. These units are 16 inches in width, have louvered bottoms, use 4500 degree white lamps and are mounted in 5-unit continuous rows across the ceiling and in 2-unit series along the wall containing racks for overcoats. Filament-lamp downlighting units are located between fluorescent units to add footcandles, sparkle and warmth to the general lighting plan. These incandescent luminaires are made by Curtis

Lighting, contain 200-watt lamps and are equipped with concentric-ring louvers in order to minimize glare from source brightness by providing sharp cut-offs.

Clothing racks are additionally lighted by a single continuous row of fluorescent lamps mounted end-to-end behind an overhead veneer valance while niches above the racks, displaying featured merchandise, are highlighted dramatically from below by PAR-38 spotlamps. Thresholds of elevators are also highlighted by recessed Curtis units mounted in the underside of a scalloped-edge cove-lighted canopy. Control is flexible to permit the creation of many moods and lighting effects.

The lighting plan and interior decoration is credited to the Grand Rapids Store Equipment Company who worked cooperatively with G. E. lighting engineers Conley and Potter. Wiring for the installation and fixture placement was by the Parker Electric Company of Cleveland.

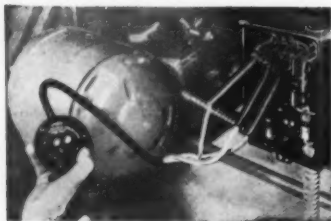


COMBINATION LIGHTING was installed by the Parker Electric Company in conformity with the overall plan prepared by G. E. lighting engineers Conley and Potter. Incandescent units are by Curtis Lighting; fluorescent fixtures were made by Crescent Metal Products.

Direct-Indirect Office Installation

Two types of lighting fixtures are installed in the District Commercial Office of the New York Power and Light Corporation, Albany, to achieve uniform high-intensity illumination free from shadows and low in brightness ratios. In the 1770-square-foot office area, 96 units are utilized, including 56 suspended Ainsworth Specialites and 40 Holophane Holoflux recessed troffer units. All units are 2-lamp 40-watt fixtures, lamps being 4-foot T-12 3500-degree white fluorescents.

The original hard plaster ceiling of 16-feet 4-inches was reduced to an even 15 feet by suspending softone acoustical tiles on a framework of carrier channels, tee runners and spline clips. Beneath this new surface, seven 8-fixture rows of indirect-direct fix-



Man-hour Saver in Checking 3-Phase Connections **The KNOPP** Phase Sequence Indicator... has nothing to adjust for reading

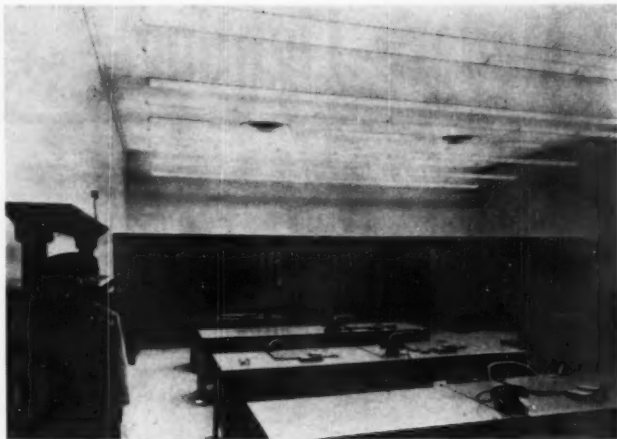
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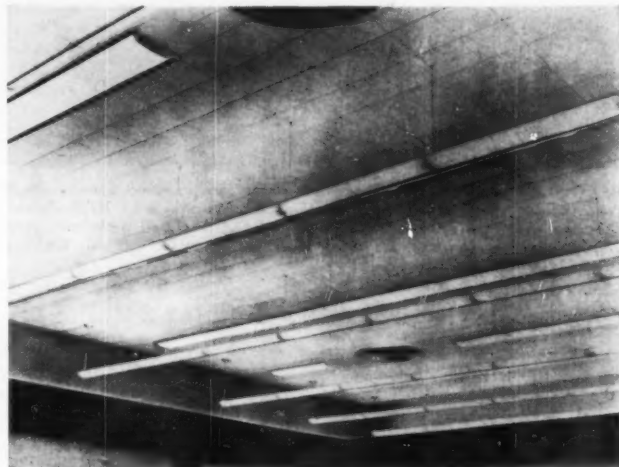
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ALTERNATE ROWS of recessed Holoflux troffers and suspended Ainsworth Specialties produce average intensities above 70 footcandles in the Albany district commercial office of the N. Y. Power and Light Corp. Upward light component from suspended units illuminated acoustical tile ceiling, keeping brightness ratios below 4-to-1 limit.



LOOKING UPWARDS towards fixtures, lighting plan is apparent, with fixtures mounted in continuous runs except where it becomes necessary to interrupt this continuity due to air-conditioning circular duct openings.

tures were suspended on 30-inch stems. The lines of recessed troffers were installed between these suspended rows of light and, except where continuity had to be interrupted to provide space for circular air-conditioning duct openings, the number of fixtures per row was also eight.

Due to these air-conditioning fixed openings, the spacing of lighting units was varied between 3-feet and 4-feet, 4-inches from row to row, with the wider distances existing furthest from surrounding wall surfaces. Lighting is controlled by 9 circuits with single pole switches mounted on 2 separate face

plates; one of which controls the suspended units (5 circuits) while the other regulates the troffers.

Before lamps had been in use for 100 hours, light and brightness readings were taken, using a Weston illumination meter and a Luckiesh-Taylor brightness meter. With suspended units in operation and with Holophane units out of service, average intensities at desk-top levels measured 50 footcandles. With troffer lighting only, these intensities became 60 footcandles and, with all units in service, the level illumination rose to 110 footcandles. Estimating normal decrease in illu-

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Q. Is the light output of a fluorescent tube affected by ballast operation?

A. Yes. Some uncertified ballasts reduce light output by 20%! **CERTIFIED BALLASTS** assure rated light output.

Q. Does the ballast affect lamp life?

A. Decidedly. Improperly designed ballasts can lower lamp life by as much as 1,000 hours in a 40 watt lamp. **CERTIFIED BALLASTS** assure full lamp life.

Q. How can one guard against overheated ballasts?

A. Use CERTIFIED BALLASTS in well designed fixtures.

Q. Do some ballasts last longer than others?

A. Yes. A **CERTIFIED BALLAST** should outlast the life of the installation.

Q. Can ballasts be a source of noise?

A. Audible "humming" is often due to the ballast. **CERTIFIED BALLASTS** produce a minimum of noise.

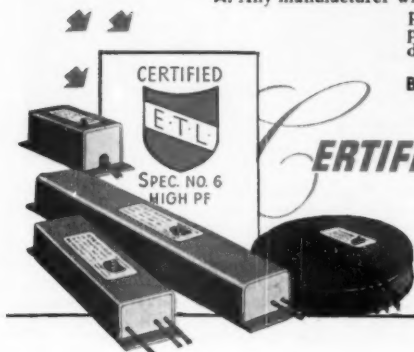
Q. What ballasts are made to exacting specifications, then tested and checked by Electrical Testing Laboratories, Inc., who certify that they conform to these specifications?

A. CERTIFIED BALLASTS!

Q. Who makes CERTIFIED BALLASTS?

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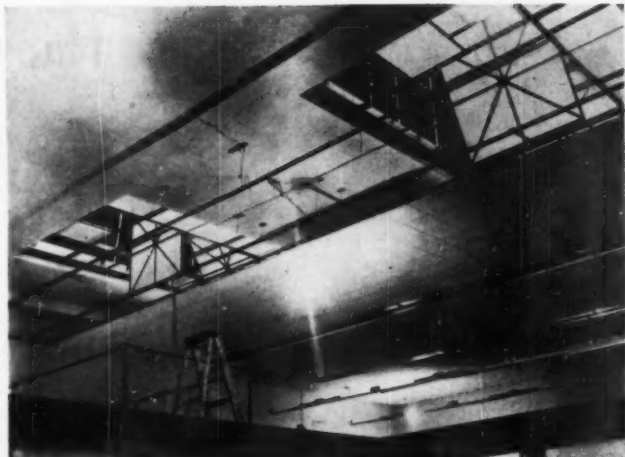
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CONSTRUCTION VIEW shows suspended ceiling partially completed, with tiles supported by framework of carrier channels, tee runners and spline clips. Carrier channels also frame troffer lines while hangers for suspended units bisect ceiling areas between these recessed fixture lines.

mination levels due to lamp depreciation and maintenance factors, average in-service readings should approximate 70 footcandles with all units in use. Brightness ratios are confined to a 4-to-1 range, with readings of 200 footlamberts on Holophane units, 190

fls. on suspended fixtures, 150 fls. above suspended units, 120 fls. adjacent to troffers, and 50 fls. on end walls taken half way between dado levels and suspended fixtures. Brightness readings were made at approximately 60-degree from the vertical plane.



BOTH ECONOMY AND BEAUTY can be combined in a narrow (less than 25 feet) store by installing a single continuous line of fluorescent lighting with two flanking rows of surface-mounted intermittently-spaced incandescent units. This is illustrated by the Chandler Store for Men in Pomona, California, where a series of 4-lamp V-bottom glass-shielded Lumidor units is used in conjunction with Holophane Counterlites on 12-foot centers. With a connected load of 3.9 watts per sq. ft., and an average counter-top illumination of 55 footcandles, the fixtures illuminate the ceiling with spill-light. Additional ceiling illumination comes from wall cases.

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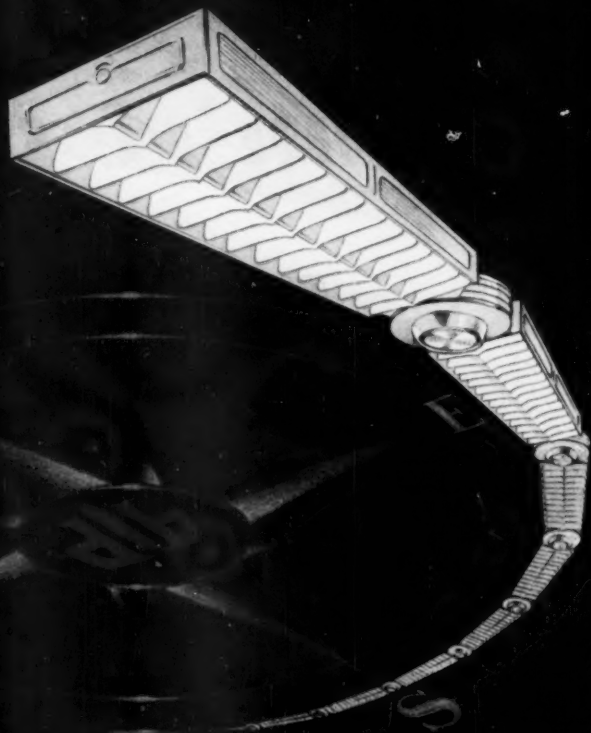


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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
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101	102	103	104	105	106	107	108	109	110	111	112	113							

Advertising
on page ..

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NAME TITLE

COMPANY

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CITY STATE 4/50

Reader Service

want more information about a new product?

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want more information on products or services advertised?

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want to ask a question and get a helpful answer?

want interpretation on a code provision?

Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

other problems? turn the page for the answer.

Dear Editor:

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Reader Service Department
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.
New York 18, N. Y.

USE THIS CARD TO ASK THEM!

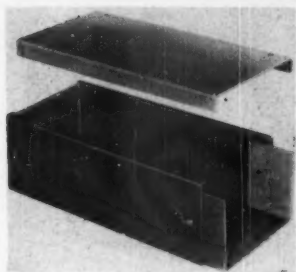
Do you have a problem in wiring layout, motor control, lighting technique?
Ask the editors.

Do you want advice on cost analysis, billing procedures, market conditions, or government regulations?
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Use the card.

To secure further information on new product or new catalog and bulletin items listed elsewhere in this section, use the card on the other side.

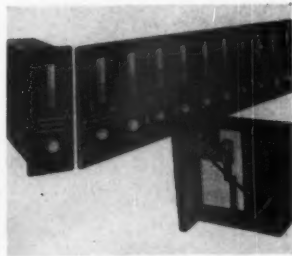
Product News



Rectangular Wireway (1)

The addition of a new rectangular 4 inch by 6 inch wireway to this line has been announced. Of the flangeless type with screw cover, it is designed to meet the special structural requirements and conditions encountered in many wiring installations. Due to its rectangular shape, it is particularly suited to meter board and panelboard installations. Available in 1, 2, 3, 4 and 5 foot lengths, they are made of heavy gauge steel with knockouts spaced on 3 inch centers on both sides and end plates to permit contractors to branch off with piping to smaller outlets along the line. It has been approved by Underwriters' Laboratories, Inc.

Keystone Manufacturing Company,
23328 Sherwood Ave., Center Line,
Mich.

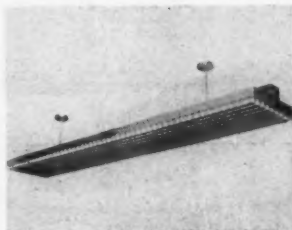


Level Indicator (2)

Announcement has been made of new level indicators with illuminated dials. Operating from any 3 to 15 lb. pneumatic transmitter or direct from valve loading pressure, a reading of liquid levels can be transmitted any distance to the new Panellit level indicator receiver. Changes in levels from any source, from any remote point, are visually reproduced on a graduated illuminated dial scale on the

face of the instrument. A solid red band on dial depicts every dip and rise in levels. Level gages are available in single units or any number of them may be grouped in multiples for flush panel mounting. The "drawer type" assembly unit makes it convenient to remove entire mechanism for inspection.

Panalarm Products Division of
Panellit, Inc., 7218 N. Clark St., Chi-
cago 26, Ill.

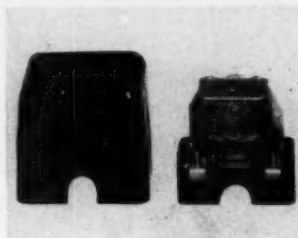


LIGHTING FIXTURE, known as the New Yorker, is available in a 96-inch size, using four 96-inch slimline fluorescent lamps, or eight 48-inch general line lamps, and in 48-inch size, using four 48-inch general line of slimline lamps. It is designed for individual suspension mounting with twin-stem or single-stem hangers. Connectors join luminaires end-to-end to form continuous rows. Manufactured by the Miller Company, Meriden, Conn.

Generating Plants (4)

Five new models of Diesel-driven electric generating plants, equipped with automatic voltage regulators and ranging from 12½ to 55 kw. have been added to this line. Engine is cranked by a 12-volt starting system. Available in all standard voltages, frequencies and phases. A battery-recharging generator is provided to maintain starting batteries at full charge. Generators may be paralleled. Basic models are furnished with necessary engine and generator controls, automatic voltage regulator and running time meter. Standard equipment includes exhaust muffler, battery cables and terminal box.

D. W. Onan & Sons, Inc., Minne-
apolis, Minn.



Relay (5)

An improved voltage-type accelerating relay, designated CR1057-J, designed for starting single-phase, capacitor-start and capacitor-start capacitor-run motors, has been announced. Relay is particularly applicable where adverse atmospheric conditions exist or where it is desired to have remote control which can be incorporated into an explosion-proof case. It can be furnished with or without cover, can be wired from top or bottom, and all parts are corrosion resistant. Relay is calibrated at factory to pick up at a predetermined voltage. Coil is wired across the start winding of a single-phase motor. Contact rating is 50 amperes at 115 volts and 30 amperes at 230 volts. In normal operation, the contact handles start winding current only.

General Electric Co., Schenectady
5, New York.



ILLUMINATED NUMBER LIGHT for homes and commercial installations has been introduced. Fixture uses a fluorescent 6-watt blacklight lamp to illuminate a special formula plastic numeral, which changes from yellow to orange-glo when light is applied. Unit is approved by UL, is weatherproof, has knockout holes in back and sides for permanent or portable installation. Operates on 110 volt, 60 cycle. Manufactured by Circlite Corp., 118 South Clinton St., Chicago 6, Ill.



Modern Fittings for



- thinwall conduit
- rigid conduit
- metallic and non-metallic cable
- flexible steel conduit
- service entrance cable
- grounding devices
- lighting fixture fittings

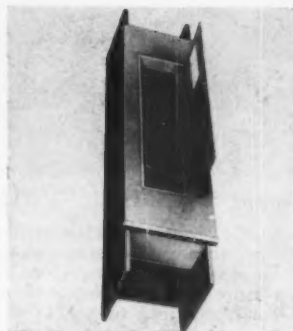
manufacturers for over 30 years

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midwest electric mfg. co. • 1639 walnut st. • chicago 12, ill.

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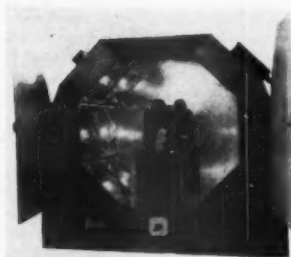
midwest



Lighting Panelboards (7)

Announcement has been made of a line of narrow width NMO-XX circuit breaker lighting panelboards to fit into the web of 8 inch wide-flange structural beams. Cabinet measures 6 1/2" wide outside. Panelboard incorporates thermal-magnetic circuit breaker units that "plug-in" on cylindrical bus-bars and are interchangeable with NMO panelboards, MO panelettes and MO-12 and MO-20 load centers. Top and bottom wiring gutters are 5 inches each and side gutters 1 1/2 inches. Cable trough and pull boxes can be supplied for concealing main and branch circuit wires running from panelboard to ceiling or roof trusses. Panelboards are available for both single phase, 3 wire, and three phase, 4 wire services with 15, 20, 30, 40 and 50 ampere branch circuits.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.

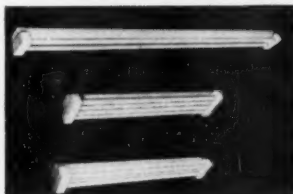


Infra-Red Oven (8)

A new infra-red oven for armature or stator baking has been announced. Model 72-648 is especially adaptable to motor repair work because of the short-time cycle required to bake a motor and low cost for operating the oven. Fractional horsepower motors can be baked out in less than 45 minutes, and 1 to 5 hp. motors, either armatures or stators can be done in one hour. It is available with JBT

temperature recording meter. It is also equipped with an automatic time control (0 to 30 minutes). Specially contoured reflectors flood energy directly onto the work and the 12 sockets symmetrically spaced to provide a high wattage concentration onto the product. G-30 lamps of 125, 250, 375 and 500 watts are all interchangeable. The approximate maximum size product oven will accommodate is 12 in. by 12 in. by 18 in. Outside oven dimensions are 45 in. wide, 22 in. deep, 39 in. high. Top of oven is louvered. Wired 220 volt single phase. Wiring terminates in outlet box.

Fostoria Pressed Steel Corp., Fostoria, Ohio.



BARE LAMP fluorescent luminaires that provide a streamline series of individual or continuous fixture have been announced. Units are designed for direct-lighting commercial application where exposed light sources are permissible. Although intended for surface mounting, units are provided with knock-outs for twin-stem and single-stem hangers where suspension mounting is preferred. Line includes two 40-watt standard lamp units, in both two- and four-lamp sizes, as well as a two-lamp, 75-watt, 425 ma slim-line unit. Manufactured by Westinghouse Electric Corp., Pittsburgh 30, Pa.

Time Switches (10)

A new line of Inter-matic time switches, known as Series TS 50, has been introduced. They feature interchangeable switches; plug-in adapter; provide up to 12 "on" and "off" operations every 24 hours. Motor is mounted in front and has an observation window; large clock dial; manual control enables user to turn switch "on" or "off" manually irrespective of time settings. Rating is 35 amp. They include single pole, single throw; single pole, double throw; double pole, single throw, low voltage switching; and poultry switch with dimmer. They carry Underwriters' approval.

International Register Co., 2624 W. Washington Blvd., Chicago 12, Ill.



Explosion-Proof Speakers (11)

Two new explosion-proof speakers for hazardous locations have been announced. Both models are complete reflex trumpet speakers with integral 25 watt driver unit and built-in multi tap line matching transformer. Model 7101 is UL approved for Class I, Group C and D which includes locations in which flammable volatile liquids, highly flammable gases, mixtures or other flammable substances are manufactured, used, handled, or stored. Model 7102 is UL approved for both Class I as well as Class II Group E, F, and G, which includes those locations in which combustible dust is through or suspended in air producing explosive mixtures, and in places where such dust may collect or settle on motors, lamps or other electrical devices.

University Loudspeakers Inc., 80 South Kensico Ave., White Plains, N.Y.



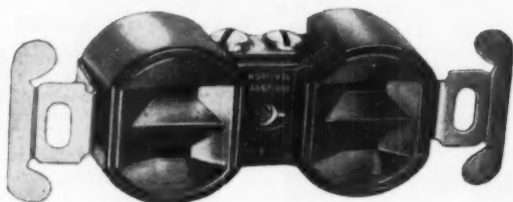
Expanding Chisel (12)

Announcement has been made of a new expanding chisel. Tool is designed to remove baseboards, but also remove door and window casings, siding, etc. Chisel is made of steel. Special pins connecting the links assure strength and endurance. Size of chisel blade is 3 inches wide by 9 inches long. Overall length with handle is 26 inches. Weight is 7 lbs.

Brehmer Distributing Co., 1036 Armstrong Blvd. N., St. James, Minn.

STA-TITE

PRECISION RECEPTACLES



Ruggedly built for heavy duty.

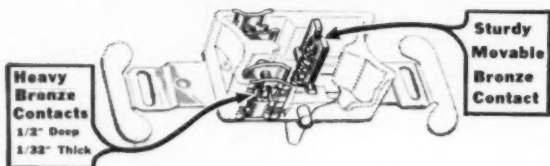
No need to purchase T-slot receptacles to obtain rigid and long-life contacts.

Heavy screws, staked and ample for No. 10 wire. Large hex assembly shaft that cannot turn from tight wall plate screw.

STA-TITE

TUMBLER SWITCH

Precision-Built for Positive Action



ONE HEAVY CONTACT BLADE

Compare this switch with any other make on the market for long life and dependability.

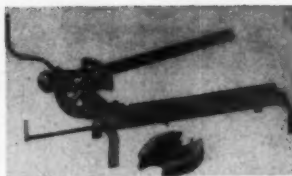
"When it's Sta-Tite, it's made right."

Meets REA specifications, and Underwriters' approved.

Highest Quality Line at slightly less than usual "quality line" prices.

Obtainable Through Your Jobber

THE STA-TITE MFG. COMPANY
816 Delaware Street Kansas City 6, Mo.



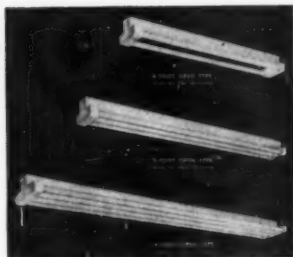
Bender

(13)

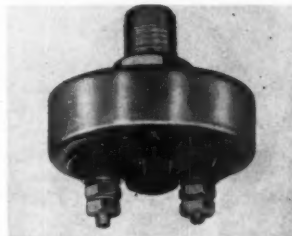
A new bending device known as Handy-Bendy, has been developed. It makes any number of uniform bends in any desired degree, including offsets in 1/2 inch and 3/4 inch rigid, EMT thin wall or aluminum conduit. It has a measuring gauge and bend degree indicator to control precision bends. It is especially recommended for use in open or slab work, or any other job where small or large numbers of bends are required. The weight is 30 lbs.

Tal Bender, Inc., Milwaukee 2, Wis.

(14)



LIGHTING FIXTURES using single pin fluorescent slimline lamps have been introduced. Fixtures are in 4, 6 and 8 foot lengths, each length available in 2, 3 or 4 lamp styles. Unit may be mounted flush or pendant individually or in continuous rows, wired with ETL approved 430 milliamp ballasts. Manufactured by Mitchell Manufacturing Co., 2525 Clybourn Ave., Chicago, Ill.



Switch

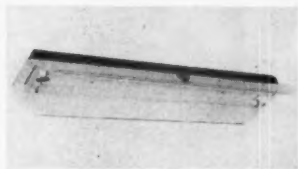
(15)

A new low pressure and vacuum operating switch has been developed. Switch can be made to operate either normally closed or normally open, with

pressure settings of from 0 to 50 psi. Maximum operating pressure may be as high as 200 psi. It may be used at temperatures to 300°F, and in systems using lubricating oil, air, brake fluids, fuel oils, etc. Switch can be supplied either with two insulated terminals or one terminal grounded. Recommended industrial applications includes use on indicating and actuating devices for fluid and air pressure systems, and similar uses on vacuum systems.

Fasco Industries, Inc., Rochester 2, N. Y.

(16)



INDUSTRIAL FLUORESCENT units with 2½ and 5-inch lamp spacing heavy-duty lampholders. Available for two and three lamps. Starters are mounted in lampholders. Units are available with open-end and closed-end porcelain enamel reflectors. Manufactured by Westinghouse Electric Corp., Pittsburgh 30, Pa.



Lighting Plant

(17)

Announcement has been made of new stand-by lighting plant. It is powered with a two cylinder, air-cooled engine. Plant can be installed in freezing atmospheres if desired. Engine is equipped with a high-tension magneto permitting hand cranking. Generator has a rated capacity of five kw. It will start single phase motors up to 3 hp. Plant is available with automatic transfer switch. Model 45HFW4 has a 5 kw., self excited, ac generator, 110/220 volt, three wire service, 60 cycles at 1800 rpm, powered with a Wisconsin, Model TF, two cylinder, air-cooled engine, 3½ inch bore, 3¼ inch stroke. Plant is 37 in. long, 28 in. high and 22 in. wide.

Kato Engineering Company, 1415 First Ave., Mankato, Minn.

Operate knock-out punches with **HYDRAULIC** power

Save at least 60% of the job time!



No Box Distortion • Close quarter operation
• Greater Safety • Punches stay sharp up to 6 times longer



Now you can punch conduit openings in electrical distribution boxes, pull boxes, etc., with smooth hydraulic power! Yes, punch 'em with ease, up to 4½". Eliminate wrench operation and distortion and loosening of boxes. Work in tightest spots. Use the same "Porto-Power" hydraulic pump and fittings which serve Blackhawk Benders. Save at least 60% of the job time! Order from your supply house today!

A KIT FOR EVERY RANGE—

Knock-out punches and the hydraulic ram are available in complete kits serving ½" up to 2" and ½" up to 4½" openings. Hydraulic equipment furnished separately for present owners of hand punches.

BLACKHAWK

HYDRAULIC **Porto-Power** EQUIPMENT

ALSO NEW!

Blackhawk's big line now also includes a **Thin-Wall Conduit Bender**. Spectacular speed. Get facts on Rigid-Pipe Benders and all new equipment by writing today for Bulletin B-50.



BLACKHAWK MFG. CO., Dept. P2040, Milwaukee 1, Wis.

Without obligation, rush Bulletin B-50 giving full facts on Blackhawk's entire line of Electrician's Equipment.

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CITY.....STATE.....



5 SECOND HEATING
no waiting, saves power

RIGID-TIP
latest in tip engineering

LONGER REACH
full 5 1/4 inches

SOLDERLITE
spotlights the work

STREAMLINED
perfectly balanced

DUAL HEAT
single heat
200 watts,
dual heat
200/250
watts,
115 volts,
60 cycles

You can do every kind of soldering with this new 250 watt Weller Gun. Power-packed, it handles heavy work with ease—yet the compact, lightweight design makes it equally suited for delicate soldering and getting into tight spots.

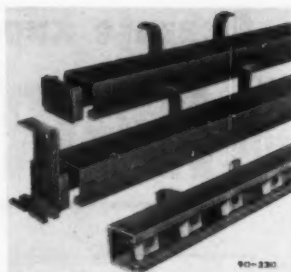
Pull the trigger switch and you solder. Release the trigger, and off goes the heat—automatically. No wasted time. No wasted current. No need to unplug the gun between jobs. 'Over and under' position of terminals provides greater visibility with built-in spotlight. Extra 5 1/4" length and new RIGID-TIP mean real soldering efficiency.

Chisel-shape RIGID-TIP offers more soldering area for faster heat transfer, and new design gives bracing action for heavy jobs. Here you get features not found in any other soldering tool... advantages that save hours and dollars. Your Weller Gun pays for itself in a few months. Order from your distributor or write for bulletin direct.

SOLDERING TIPS—get your copy of the new Weller guide to easier, faster soldering—20 pages fully illustrated. Price 10c at your distributor, or order direct.



WELDER
MANUFACTURING COMPANY
815 PACKER STREET • EASTON, PA.

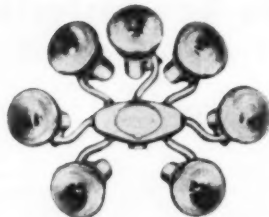


Concrete Insert

(18)

Announcement has been made of a new concrete insert. Attachments are easily made at any point along entire channel without disturbing other attachments. This is accomplished by insertion of the Uni strut spring nut into the channel at the point where attachment is desired, and bolting to fitting. This bolting action secures the nut tight to "double track" formed by inturned edges of channel, provides positive clamping action and prevents slippage. Known as Series P-3000, inserts may be had in stock lengths from 3 inches to 20 feet, and are available with Type A plain drive-in end caps or Type B anchor type drive-in end caps equipped with slots for centering and nailing. Insert channel measures 1 1/2 in. wide by 1 1/2 in. high outside dimensions.

Uni strut Products Co., 1013 W. Washington Blvd., Chicago 7, Ill.



Lampholders

(19)

The entire line of Beam-A-Lite sealed-beam directional lampholders has been redesigned. Two sizes are available, one for the 150-watt PAR-38 spot or flood lamp, and the other for the 300-watt R-40 flood lamp. Both lampholders are cast aluminum and incorporate an adjustment screw in the back to insure a weathertight fit of lamps regardless of lamp variations. A complete line of accessories is also available. This includes a specially designed multiple junction box.

Bright Light Reflector Company, Inc., Fairfield Ave. & State St., Bridgeport 5, Conn.

Pilot Light

(20)

A flush Neon pilot light has been announced. Adaptable for use in all combinations as well as a single unit. Available in brown or ivory. Has unbreakable, prismatic Plexiglass dome. It is a cold pilot light, as Neon lamp gives off no heat. Rating 1/25 watt lamp, 125 volts.

Pass & Seymour, Inc., Syracuse 9, N. Y.



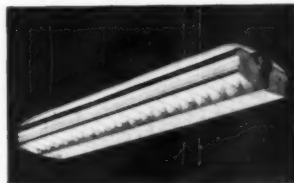
Cabinet Assembly

(21)

Circuit selector cabinet assemblies designed to meet CAA Specifications L-816 and L-817 are available. Designed for either series or multiple operation, the assemblies are used for the selection of runway or taxiway lighting circuits supplied by constant current regulators of 5-kw rating or less, having 6.6 amp secondaries, or by transformers with 600-volt secondaries. Relays or contactors of the assemblies are controlled remotely from the airport control tower or operations center to select the desired lighting circuit.

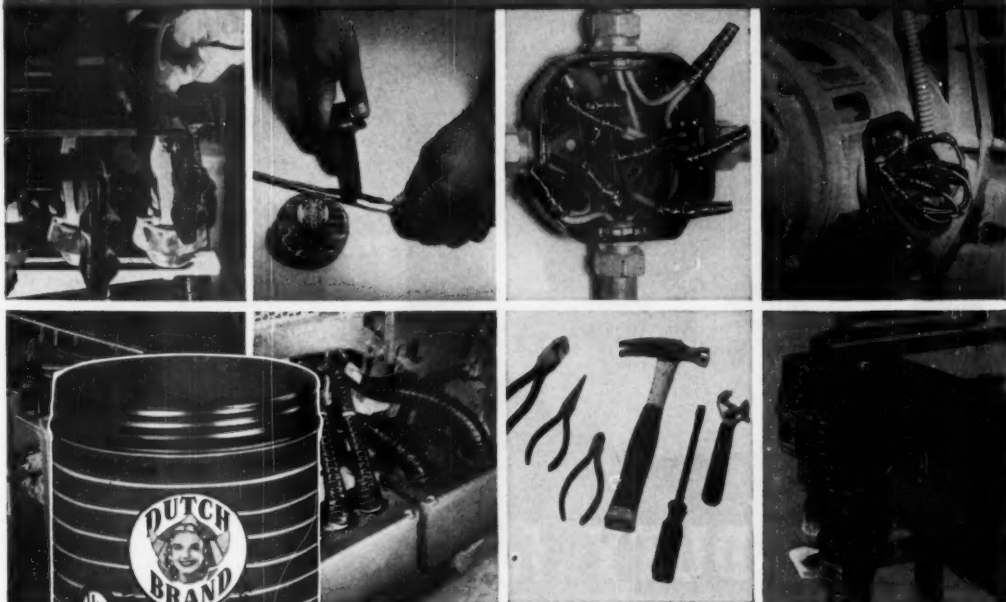
Westinghouse Electric Corp., Pittsburgh 30, Pa.

(22)



LUMINOUS FLUORESCENT fixture, known as the Guthglox, has been announced. Unit is equipped with Polystyrene plastic or Albalite glass side panels. Translucent side panels direct a portion of light upward and outward. Available for standard 40-watt lamps and also for 4 ft. and 8 ft. slimline single-pin lamps. Manufactured by Edwin F. Guth Company, 2615 Washington Ave., St. Louis 3, Mo.

Try the New DUTCH BRAND PLASTIX Electrical Tape



5
ROLLS TO
RE-USABLE
CONTAINER

Superthin Construction with High Dielectric Resistance ... Conforms readily to irregular surfaces

DUTCH BRAND PLASTIX Electrical Tape is made by the manufacturers of electrical tapes for the past forty years. It is made with a full understanding of electrical requirements. You'll find Plastix is used in those many places where space is limited

and a superthin tape is needed.

DUTCH BRAND PLASTIX Electrical Tape is the result of careful study and research and meets the recognized high quality standards established by all other DUTCH BRAND electrical tapes.

FEATURES THESE MANY OUTSTANDING QUALITIES

TEARS READILY... in spite of its strength and stretch.

CONFORMS TO IRREGULAR SURFACES... superthin, great flexibility and stretch make excellent conformity.

RESISTS WEATHER rain and rough weather do not affect it... favorably withstands relatively high or low temperatures.

RESISTS ACIDS, ALKALIES, CORROSION... wherever present... in chem-

ical plants, around machinery, etc.

EXTRA-HIGH DIELECTRIC RESISTANCE... a single thickness resists 8000 volts which is greater than 1000 volts-per mil of thickness.

EXCELLENT ADHESION... the quality of the adhesive and the even coating assure excellent adhesion.

TENSILE STRENGTH... it is strong... has ample strength for all types of applications.



Order From Your Jobber

VAN CLEEF BROS. INC.

Manufacturers... Rubber Products... Est. 1910
CHICAGO 19, U. S. A.



HEAVY-DUTY for Pressures Up to 1/4"!

"Buffalo" "NV" BREEZO FAN

Yes, heavy-duty! The die-stamped panel, arms and motor bracket are strong and rigid to STAND UP, as the illustration shows. "Buffalo" "NV" HEAVY-DUTY BREEZO FANS are easily installed, too, as are other "Buffalo" disk fans. Plenty of jobs — and plenty of DEMAND for this well-established line of fans! LET US MAIL YOU PRICES AND ENGINEERING DETAILS.

- 7 sizes, 12" to 36" to deliver up to 15,000 cfm!
- 4 sturdy blades, shaped to move maximum air!
- WRITE for Bulletin 3222-F1



BUFFALO FORGE COMPANY

520 BROADWAY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

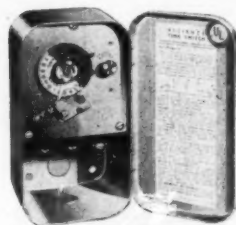


Lighting Units

(23)

A new two-lamp Module lighting system has been announced. Companion piece to the 4-lamp system, the new units are identical in design and appearance. They can be used exclusively throughout a modular pattern or may be electrically and mechanically joined to 4-lamp units in a single Module installation. Lighting units arranged in building block fashion can be patterned to fit any architectural design for stores, offices, commercial buildings, showrooms.

Mitchell Manufacturing Company,
2525 Clybourn Ave., Chicago, Ill.



Time Switch

(24)

A new time switch designated as Model 400, has been added to this line. Available in single pole, single throw construction and rated at 20 amp, 125 volt. Timing element is synchronous motor driven with a precision gear train and vernier time set. Indicator revolving at 1 rpm shows when timing motor is running. Contacts are silver-to-silver and numbered terminals are provided for all connections. Cabinet is 4 by 7 1/4 by 3 1/4 inches deep. Four 1/2-inch knockouts are provided in sides, bottom and back. Switch operates on a 24-hour schedule, automatically closing and opening circuit once daily. It is especially suitable for the automatic control of circuits up to 2500 watts, such as small window lighting installations, signs, oil burners, residential protective lighting, air conditioning and poultry house lighting.

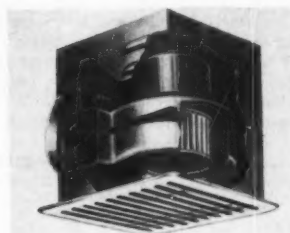
Reliance Automatic Lighting Co.,
Racine, Wis.



Soldering Iron Torches (25)

Announcement has been made of two new internally-fired soldering iron torches. The No. 1-S is designed for fine work and No. 2-S for heavy soldering. Soldering irons can be heated in less than two minutes and then the torch flame can be adjusted to keep the coppers at the correct temperatures for continuous soldering. Torches are attached to the Insto-Gas cylinder by special hose furnished in 12½ ft. or 25 ft. or 50 ft. lengths. Coppers on soldering iron torches are easily removed for replacement or exchange where flat type or extra heavy coppers are required. Listed by Underwriters' and Factory Mutual Laboratories.

Insto-Gas Corporation, 1977 East Woodbridge Ave., Detroit 7, Mich.



Ventilator (26)

A new ceiling ventilator, Model 1201, equipped with a squirrel cage blower and designed especially for bathroom installation. The 4-inch blower wheel in the unit is driven by a 1/75 hp. motor and delivers 100 cfm. Motor in bathroom unit is located entirely outside the air stream. Sheet metal housing which incorporates a conduit box and knockouts is permanently installed in the ceiling joist space. Blower unit is installed or removed from housing by means of positive friction catch and electrical plug.

Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles 37, Calif.



Model 5025-SR with outlet in molded bakelite handle

GREATER STRENGTH

cuts risk of lamp breakage

Buy McGill lamp guards and you've got the best . . . the strongest . . . the longest lasting guards you've ever seen. Compare McGill with any other guard. Point for point — in cages, handles, sockets or cords, — you will see the superiority of McGill that means longer service and better protection from lamp breakage. No matter what your guard needs may be, there is a built-to-be-better McGill lamp guard to fit the bill exactly.

The most popular series made. Has strong wire cage and molded rubber handles. Strain relief disc protects cord terminals. The same construction with wooden handles is available in the 8000 series.



Model 7000-SR



Model 3006

Where gas, fumes or dust create hazardous conditions, McGill vaporproof guards offer the utmost in lighting protection. Choice of several models to fill every need.

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER



For New Catalog No. 49 Write: McGill Manufacturing Co. Inc., 450 No. Campbell St., Valparaiso, Ind.



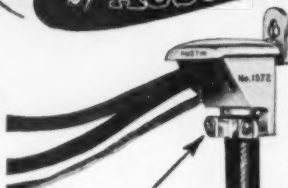
McGILL

electrical
specialties

ONLY McGILL MAKES Lerchier SWITCHES

ENTRANCE CAPS AND FITTINGS of Rustproof Cast Aluminum Alloy

by **AUSTIN**

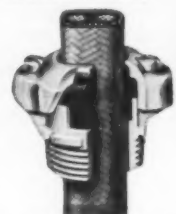


No. 1572 Entrance Head.
Key-hole mounting bracket
for easy attachment to
building.

No. 275 One Hole Strap
for oval-shaped cable.



No. 2275 Two Hole Strap
for oval-shaped cable.



No. 50-36 Watertight Connector.
Cutaway view illustrates how 3-point
compression forces rubber gland around entire
circumference of cable.



No. GR-1 Grounding Ring.
For bonding meter box to artificial ground.
Tight connection and positive bond without
soldering.

No. 6009
Non-watertight
Connector. Takes
a wide range of
sizes and types of
cable, round or
oval, without the
use of shims or in-
serts.



No. L-63
Sill Plate Provides
metallic protection
to service en-
trance cable at the
most hazardous
point—where it
enters the build-
ing.

SOLD THROUGH ELECTRICAL WHOLESALERS

The M. E. Austin Company
NORTHBROOK, ILLINOIS

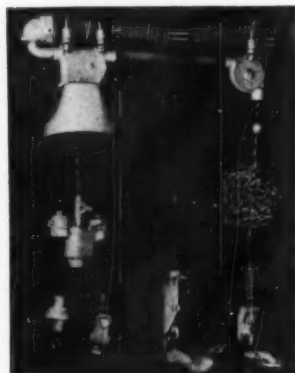


Switch

(27)

Announcement has been made of No. 1AH2 normally-open pendant switch and No. 1AH3 normally-closed pendant switch. They are Underwriters' Laboratories listed for 10 amperes, 125 or 250 volts, ac; $\frac{1}{4}$ hp. motor at 115 volts, $1\frac{1}{2}$ hp. 230 volts, ac. High electrical rating is combined with high inrush capacity, making them suitable for controlling tungsten filament lamp loads of 1,000 watts on ac circuits. Plastic case is molded in two halves, held together with two recessed screws that pass through mounting holes of enclosed basic switch. Overall length of plastic housing is $4\frac{1}{4}$ in., width $\frac{3}{4}$ in. and height $1\frac{1}{8}$ in.

Micro Switch, Freeport, Ill.



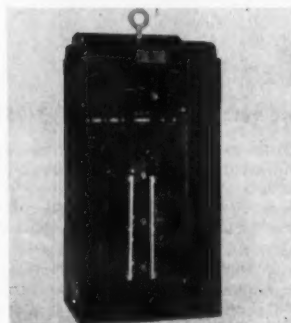
Aluminum Hanger

(28)

Announcement has been made of four new all-aluminum unit packages which have been developed especially for all types of outdoor lighting installations. They contain a complete Thompson disconnecting and lowering hanger, a lighting fixture adapter (for either pendant or yoke-type fixtures), a slip-fit elbow, bracket end, U-bolts, filler blocks, a fixed position corner

pulley, a specified length of galvanized chain, and (optional) an open-type lock box with a spring-loaded terminal link or a fully enclosed, pulley-equipped lock box for use with conduit enclosed vertical chain runs.

Thompson Electric Company, 1101-57 Power Avenue, Cleveland 14, Ohio.



Rectifier

(29)

New 2S Series single and three phase selenium rectifiers have been announced. They are employed in all types of industry; mines, grain elevators, stone quarries, power plants, machine shops, printing houses, die shops, in conjunction with any equipment requiring direct current. Available in six series, which include various combinations of normal convection cooling, fan cooling, auto transformers, and double wound transformers. De output voltages are 115 volts or 230 volts, in capacities of from 57 watts to 80 kilowatts. Dual ac inputs are 115/230 volts or 230/460 volts; single voltage ac inputs are 208, 230, or 460 volts.

Accurate Engineering Co., 2005 Blue Island Ave., Chicago 8, Ill.

Recloser

(30)

A new three phase automatic recloser, designated Type FR-3, with maximum service ratings of 100 amperes, 15,000 volts has been announced. Primarily designed for rural distribution systems, the new unit has a short circuit interrupting capacity of 3000 amperes. It combines three FR-1 single-phase reclosers in a single unit. Eliminating the hazard of burning out three-phase loads by having only one phase lock-out, the new units employ a common linkage that assures positive operation in locking-out all three phases whenever a permanent fault occurs.

General Electric Co., Schenectady, N. Y.

FIELD-PROVED and ACCEPTED *thousands in daily use!*

**THE ONLY POCKET-SIZED
SPLIT-CORE VOLT-AMMETER**

1/2 the usual size! only 7"

1/3 the usual weight! only 14 oz.

1/2 the usual price! only \$42⁷⁵

**measures current instantly, safely, accurately
without interrupting circuit or breaking insulation!**

Thousands of Amprobe have been in daily use for months—in major plants, in famous laboratories, with utilities and government agencies, on construction jobs, in motor repair shops. Rarely has an instrument been given such unqualified acceptance by users in the field. This is a real tribute to Amprobe's accuracy, its ruggedness, its soundness of design and construction.

Amprobe has taken the split-core volt-ammeter out of the "heavy equipment" class and made it a *personal* instrument.

AMPROBE* is so compact, you can slip it into your pocket, or carry it on your belt.

AMPROBE* gives you an instant current reading "right on the nose" without touching the conductor or interrupting the circuit. (You just press the trigger to open the spring-controlled jaws; then release the trigger to close probe jaws around the conductor).

AMPROBE* is ruggedly constructed and can be roughly handled without fear of breakage.

Once you've held the Amprobe in your hand, once you've discovered how convenient it is to carry and to use, you'll understand why an Amprobe in the hip pocket is fast becoming the "trade mark" of the up-to-date electrical engineer, maintenance man, electrician, and motor service man. Technical Bulletin sent on request. PYRAMID INSTRUMENT CORP., 49 Howard St., New York 13, N.Y.

A PYRAMID INSTRUMENT

see it, try it today at all better electrical distributors



Complete with plug-in type voltage test leads and genuine top grain cowhide leather case.

THE AMPROBE* IS AVAILABLE IN THREE MODELS:

MODEL A-5

AMPERES: 0/6.5/13/
26/65/130 amps
VOLTS: 0/130/260
VAC

MODEL A5-1

AMPERES: 0/6.5/13/
26/65/130 amps
VOLTS: 0/150/600
VAC

MODEL A-6

AMPERES: 0/10/25/
50/100/250 amps
VOLTS: 0/150/600
VAC

FREQUENCY: 50-70 cycles

VOLTAGE BREAKDOWN TEST: 3,000 Volts A.C.

ACCURACY: $\pm 3\%$ (of full scale deflection)

SCALE LENGTH: 2.47 inches

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DESCRIPTIVE
LITERATURE

PYRAMID INSTRUMENT COMPANY

Dept EC40

49 Howard Street, New York 13, N. Y.

Please send me Bulletin 109D describing the Amprobe* split-core volt-ammeter.

Name.....

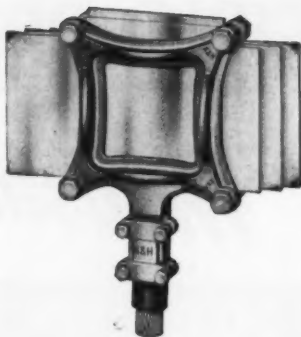
Company.....

Address.....

City..... Zone..... State.....

Our local electrical distributor is:.....

Runway light wiring and other signal and landing light wiring at scores of progressive airports all over the nation is protected against moisture, oil, acids, etc., by "SCOTCH" No. 33 Electrical Tape.



Bus Bar Clamps (31)

Announcement has been made of new three-bolt and four-bolt bus bar clamps with lug for cable connections. Design is of one-unit construction. Rib construction reinforces the clamp where the strain is greatest. Steel or silicon bronze bolts used as requested. Bus bar clamps with lugs connected can be furnished in a wide range of tubing sizes, as well as connectors for cable sizes and bus bars. Two wire lugs can be furnished with bus bar clamps on request.

Krueger & Hudspeth, 3 East Third Street, Cincinnati 2, Ohio

How plastic tape helps make night landings safer



EMERGENCY TOWER FEEDER at the Houston, Texas Municipal Airport being insulated with "SCOTCH" No. 33 Electrical Tape. Plastic backing of tape is abrasion-resistant, withstands moisture, won't crack, chip or peel. Wiring recently weathered a 90-mile-an-hour hurricane with no damage.



FIELD LIGHT WIRING splices at the Houston Airport are dependably protected with "SCOTCH" No. 33 Electrical Tape. This is only one of the many insulating problems that can be solved with "SCOTCH" Electrical Tape. Write Dept. EC-450 for complete information, today. There will be no obligation.



Fish Tape Reel (32)

Announcement has been made of new "Hi" fish tape reel and fish tapes. Some of the features are offset seam eliminates sharp edges; permanent "black magic" finish, which will not chip or rust; hazards of loose tape eliminated as reel keeps unused tape coiled, ready for use; tape winds in and out under correct tension. "Oil tempered", flat spring steel fish tape. Available in popular lengths of 1/4 in. by .060 in. and 1/2 in. by .060 in. tapes.

Holub Industries, Inc., Sycamore, Ill.



Made in U. S. A. by **MINNESOTA MINING & MFG. CO.**, St. Paul 6, Minnesota
also makers of other "SCOTCH" Brand Pressure-Sensitive Tapes, "SCOTCH" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives.
General Export: DUREX ABRASIVES CORP., New Rochelle, N. Y.
In Canada: CANADIAN DUREX ABRASIVES LTD., Brantford, Ontario

Cable Reel

(33)

A new and improved model of Powereel, 3000 Series, is designed for simplifying the handling of long heavy electrical cables. A new 2-wheel hand truck, consisting of a handlebar and separate axle with two rubber-tired wheels made for attachment to Powereel is available if desired. Frame is welded tubular steel construction with supports as sled runners to facilitate moving reel in and out of trucks, tool rooms, about job location. Rated at 75 amps at 220 volts and designed for use with any phase current. Collector ring permits winding or unwinding of cable without interrupting service. Reel comes with either three or four collector rings as standard.

Industrial Electrical Works, 1509 Chicago Street, Omaha 2, Neb.

(34)



COMMERCIAL FLUORESCENT units available in a variety of types, including two or four-lamp units in four-foot lengths, accommodating 40-watt lamp or two- or four-lamp units in eight-foot lengths using 96-inch T-12 slimline operated at 425 ma. When suspension mounted, units have direct-indirect photometric distribution; when surface mounted, distribution is semi-direct. Made by Westinghouse Electric Corp., Pittsburgh 30, Pa.

Product Briefs

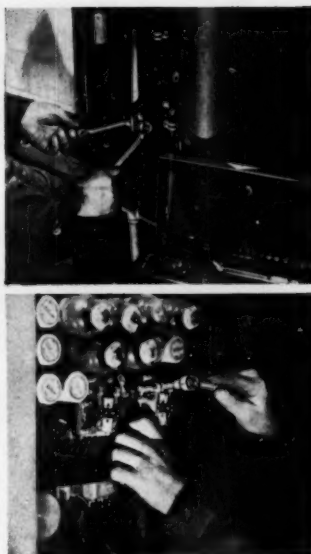
(35) Ark-Les Switch Corp., Watertown, Mass., has announced a new momentary-contact switch. . . (36) Announcement has been made of a new Series "400" alarm signal system designed for use in hazardous and corrosive atmospheric locations, by Panalarm Products, Inc., Chicago, Ill. . . (37) An air tight case for holding both line and pigment is a feature of the new self-chalking chalk-line box produced by "Strait-Line" Products, Santa Ana, Calif.

(38) Syntro Company, Homer City, Pa. has announced a new self-rotating, hole cleaning gasoline hammer rock drill. . . (39) A new attachment de-

Snap-on*

basic ELECTRONIC CONTROL SERVICE TOOL KIT

... cuts "down-time" to a minimum ... speeds maintenance ... because you always have the right tool at the right time



This complete 51-pc. kit with Handy Hold-all Box for only

\$55.65

Includes

- 1 Midget Set 1/4" drive including . . . Ratchet, Sliding Tee, Nut Spinner, Flexextension
- Plastic Grip Handle Universal Joint
- 2" and 4" extension
- 8 Hex. Sockets
- 3/16" to 7/16"
- 8 Deep Hex. Sockets
- 3/16" to 7/16"
- 3 Square Sockets
- 1/4", 5/16", 3/8"
- 4 Dwarf. Boxsockets
- 5/16" to 3/4"
- 8 Ignition Wrenches
- 7/32" to 3/8"
- 1 9-1/4" Screw Starter
- Yungsten Ignition File
- 6" Mill Rastard File
- 5" Gripper Pliers
- 6" Diag. Cutter Pliers
- 6" Needle Nose Pliers
- 5 Screw Drivers
- 4" Offset, 1-1/2" and 2-1/2" Stubby, plus a 3" and 4" blade
- 1 Red Hold-all Box

Actually tested in the shops where "down-time" must be held at an absolute minimum, this kit has proved its value over and over again. It contains all the basic tools you will need . . . and they're Snap-on tools, built and sized to precision tolerances with the feel and balance that gives you fast nut-turning efficiency. Check the complete list at the right . . . tear out coupon and mail today.

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KENOSHA, WISCONSIN

*Snap-on is the trademark of Snap-on Tools Corp.



Please send me the \$55.65 Electronic Control Service Kit, No. TM-151. I am enclosing . . .

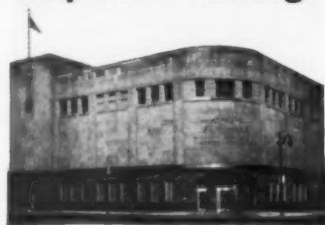
☐ Check ☐ Money Order ☐ Company Purchase Order

NAME

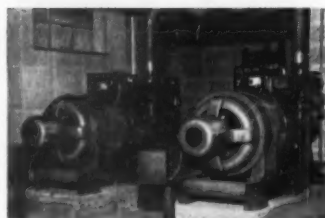
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CITY.....ZONE.....STATE.....

Another modern telephone exchange



is sure of
continuous power



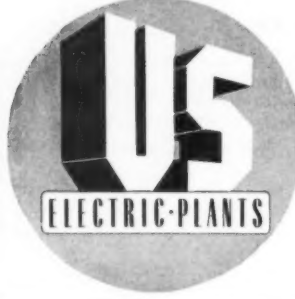
with "U.S." stand-by Electric Plants

IN telephone service, stand-by power is chosen for its dependability. That's why more and more telephone companies are turning to "U.S." . . . that's why "U.S." was selected by the Indiana Associated Telephone Corporation for this beautiful new building in Elkhart.

In any business, wherever stand-by power is needed, it will pay you to get the facts about "U.S." units. Complete line includes units from 300 watts to 175 KW. Diesel, gasoline or gas.

UNITED STATES MOTORS CORP.
580 Nebraska St., Oshkosh, Wis.

Export Dept., 212 E. Washington Ave., Madison 3, Wisconsin, U.S.A.



veloped for tungsten carbide bits has been announced by Ingersoll-Rand Company, Phillipsburg, N. J. . . . (40) Saginaw Bearing Co., Saginaw, Mich., has announced a new replacement split thrust washer.

(41) An insulation tester to assist in the development and control of insulating coatings for copper wire, and other applications involving dielectric stress studies, is available from Westinghouse Electric Corp., Pittsburgh, Pa. . . . (42) The 1950 line of room air conditioners has been announced by Mitchell Manufacturing Company, Chicago, Ill. . . . (43) The "Reel-O-Matic", a new machine designed to expedite distributor handling of all types of wire and cable in meeting customer orders has been developed by Marion Electric Company, Detroit, Mich.

(44) The addition of new-size lighting fixtures, known as Decoralite, Junior, has been announced by Lightolier, Inc., New York, N. Y. . . . (45) H-B Instrument Company, Philadelphia, Pa., has developed a new, quick set thermo-regulator, which can be adjusted over a wide control range. . . . (46) Hastings Instrument Company, Hampton, Va. has announced an electrical air-meter with temperature compensating probe.

(47) Portable electrical cords and cables with jackets certified to contain not less than 60% by weight of new Neoprene are being introduced by Western Insulated Wire Co., Los Angeles, Calif. . . . (48) Two designs in a 425-ma ballast for the 96-inch, T-12 Slimline fluorescent lamp are available from Westinghouse Electric Corp., Pittsburgh, Pa. . . . (49) A new plastic-type sealing cap which fits over the ends of fluorescent sign tubing and permits color identification of tube itself, has been introduced by Sylvania Electric Products Inc., New York, N. Y.

(50) A new instrument for testing all electrical circuits and appliances has been introduced by Amsterdam Sales Co., New York, N. Y. . . . (51) Sterling Electric Motors, Inc., Los Angeles, Calif. has developed an improved line of gear head electric motors, known as "Slo-Speed" motor. . . . (52) Standard Electric Mfg. Co., Inc., West Berlin, N. J. has introduced new air blowers for ventilation, coal and coke fires, light dust removal, and other air moving applications.

(53) Two new megohm meters have been announced by Industrial Instruments, Inc., Jersey City, N. J. . . . (54) DYAB tandem motors are for wire recorders, vending machines, measuring instruments, positioning mechanisms, and other applications requiring a reversible motor. It is manufactured by Barber-Colman Company, Rockford, Ill. . . . (55) Ward

Industries, Inc., Chicago, Ill. has announced a new "Twin-Breeze" fan, tailored for the casement window.

(56) A new line of air handling units, designated Types AH and AV, intended primarily for remote installation in central plant type air conditioning systems is available from Westinghouse Electric Corp., Pittsburgh, Pa. . . . (57) A new line of miniature ceramic disc capacitors, identified as Tiny Mike has been announced by Cornell-Dubilier Electric Corp., South Plainfield, N. J. . . . (58) Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif. has produced polyethylene-covered aluminum line wire, a new electrical conductor.

(59) Add-A-Lites, fluorescent circles that can be attached in layers upon each other to achieve 3, 4 and 5 circles of light in one fixture, have been introduced by Circular Luminaires, Inc., Portchester, N. Y. . . . (60) Feranti Electric, Inc., New York, N. Y. has announced an electrostatic high voltage indicator. . . . (61) A new utility tester for testing all electrical circuits and appliances has been announced by General Electronics Distributing Co., New York, N. Y.

(62) General Electric's Lamp Department, Cleveland, Ohio, has announced the development of a new type of incandescent electric light, which employs a unique shape and an enamel finish to form a combined light source and fixture in one unit. . . . (63) Turner Brass Works, Sycamore, Ill. has introduced a new half pint, self-pressure torch. . . . (64) Paine Company, Ill. has introduced a new "Sudden Depth" drill with automatic dust ejector.

(65) A new industrial flashlight battery has been developed by the National Carbon Division, Union Carbide and Carbon Corp., New York, N. Y. . . . (66) Carter Products Corp., Cleveland, Ohio, has announced new Carlon "T" rigid plastic pipe. . . . (67) A new automatic portable electric heater with a built-in thermostat has been announced by Electromode Corporation, Rochester, N. Y. . . . (68) A fire alarm system has been developed by Thomson-Campbell, Ltd., Adelaide, Australia.

(69) Wincharger Corporation, Sioux City, Iowa has announced a standby ac generator for farm and ranch use. . . . (70) Pennsylvania Transformer Company, Canonsburg, Pa. has introduced a complete line of load ratio control transformers, step voltage regulators and unit substations. . . . (71) New aluminum alloy "tube-and-coupler" scaffolds designed for heavy construction work and for industrial maintenance have been announced by Up-Right Scaffolds, Berkeley, Calif.

TRIANGLE'S TRIEX

Non-Metallic Sheathed Cable

**SAVES TIME
SAVES TROUBLE
SAVES MONEY**

at Every Connection

You save time, save trouble, save money at every step of the wiring job when you use TRIEX Non-Metallic Sheathed Cable. Its "Glazon" covering handles cleaner, stands more punishment, takes less space, bends easier around corners — yet affords extra protection for year-in, year-out dependability.

And an important feature, in the smaller sizes of TRIEX, saves you still more time in making every connection. No longer must you wrestle with paper curlicues to prepare the wire for stripping — on sizes 14 and 12 TRIEX, extra insulation thickness takes the place of these paper wraps. Actual tests prove this new TRIEX prepares for stripping five times faster!



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TRIEX

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Both types listed by Underwriters' Laboratories for 60°C. service, 600 volts. Approved by R.E.A. Two or three conductors, with or without ground wire, No. 14 through No. 4 A.W.G.

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Of the Complete
Triangle Line

"Glazon" & "Trioseal" Building Wire • "Tricon" Control Wire •
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"Trioprene" Trench Cable • Service Entrance, Parkway, Power & Var-
nished Cambric Cables • "Tristeel" Flexible, Thin Wall & Rigid Steel Conduit

CATALOGS and BULLETINS

(72) SIGNALS and telephone systems for apartment house use are the subjects of bulletins 110 and 160 including information on chimes, door openers, wiring diagrams, applications, installation notes. Auth Electric Co.

(73) SELENIUM RECTIFIER dc welders are discussed in booklet DB 26-100 with general engineering data, performance characteristics, construction details, electric characteristics, dimensions and weights. Westinghouse Electric Corp.

(74) CODE SIGNAL RELAYS for fire alarm use are presented with wiring diagram, photographs and text in bulletin FA2 (revised). Cannon Electric Development Co.

(75) DIMMING equipment, from 1 to 30 kw, manually operated and motor driven, for brightening and blending of light in theatres, stores, churches, schools and restaurants are illustrated and specified in Bulletin 749. Superior Electric Co.

(76) PANELBOARDS, safety switches, Noark panellets, main pull switches, push-button stations and wiring troughs are described, specified and priced in 16-page 2-color bulletin MM-1. Federal Electric Products Co.

(77) WINDOW FANS for 3-speed 60-cycle 110v ac operation, with capacities to 3520 cfm, for homes, apartments, offices, schools, etc., are subject of file sheet. Circulators & Devices Mfg. Corp.

(78) ELECTRIC HEATING with open coil, tubular and cast-in tubular units is discussed in 4-page bulletin D49. Thermal, Inc.

(79) CURRENT INDICATOR, ammeter and volt-amp tester for ac use are priced, pictured and described in file 17-12-49. Industrial Devices, Inc.

(80) DRY TYPE TRANSFORMERS are presented with rating tables, weights, list prices and wiring diagrams for units with capacities of 200 kva single-phase and 300 kva three-phase. American Transformer Co.

(81) LOW TEMPERATURE WELDING and brazing rods and fluxes, with hints, tables and characteristics, are



PAINE "SUDDEN DEPTH" DRILL BITS

make it possible to place the anchor without cleaning the hole!

Now you can drill even the hardest materials easier and faster. The new Paine "Sudden Depth" Drills are equipped with automatic dust ejector — a thin, durable wire wound around the shank that spirals the dust and dirt out of the hole as you drill. Holes are kept clean, permitting the drills to bite into concrete and masonry with maximum speed and with less wear. You save valuable time on the job . . . no dust to dig and to blow out . . . no dust explosions. Get Paine "Sudden Depth" drills with the automatic dust ejector today. No increase in prices.

Paine "Sudden Depth" drills, with automatic ejectors, are immediately available in round shank models from 1/4" to 1" sizes inclusive.

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contained in 32-page pocket-sized handbook. All-State Welding Alloys Co., Inc.

(82) **ELECTRIC HAMMER** with accessories for drilling, grinding and sanding is subject of 2-color pamphlet. Wodack Electric Tool Corp.

(83) **PANELBOARD CIRCUIT BREAKERS**, non thermal, fully magnetic, with graphs, ratings and diagrams are presented in bulletin 3100. Heinemann Electric Co.

(84) **VOLTAGE REGULATOR** for close regulation on low capacity feeders and rural service is described with photographs, wiring diagrams, specifications, general data. Allis-Chalmers.

(85) **CUSHIONING** materials, combined with clips, clamps and brackets are illustrated and detailed in 1950 catalog discussing wide variety of units and cushion combinations. Thomas Associates.

(86) **ELECTRIC PLANTS** with 2 to 60-kw capacities, dc or ac, 50 or 60 cycles, are discussed in 4-page form A192B-20M-749 describing mobile power plants that combine gasoline starting and diesel running. D. W. Onan & Sons Inc.

(87) **ELECTRICAL CONTACTS** with silver facing individually bonded to steel backing for projection welding to contact supports are described in circular 501. Gibson Electric Co.

(88) **CALL STATIONS** for hospital installations are presented with wiring diagrams, pictures and dimensions as a 2-fold 6-sheet file sheet. Cannon Electric Development Co.

(89) **GEAR MOTORS**, 13 types, 30 sizes from 450 to 0.05 rpm, 1/20th to 7.5 hp, are subject of bulletin 3-100. Janette Manufacturing Co.

(90) **LOW TEMPERATURE INSULATION** with K factor of 0.21, manufactured from expanded rubber compound and used as structural barrier, is vapor, rot and vermin-proofed. A 20-page booklet. Rubatex Division, Great American Industries, Inc.

(91) **DUST COLLECTORS** for industrial use, from 200 to 3600 cfm capacities, are presented in bulletin 610, showing pictures, specifications, applications and dimensions. Agat-Detroit Co.

(92) **STATIC CONTROL** equipment for the control of fire or explosion hazards in industry is subject of 3-color 4-page file folder. The John Hewson Co.

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"#1100 is a

Find for windings!"

*That's why hundreds of
new users have
switched to*

**Irvington
#1100**

*clear, stable
insulating varnish*



Specifications:

Dry Dielectric	2000 VPM
Moisture Resistance	Good
Oil Resistance	Excellent
Acid Resistance	Excellent
Alkali Resistance	Good
Heat Resistance	Very Good
Penetration	Excellent
Baume	25° @ 30 deg. C.
Sp. Gr.	0.903 @ 30 deg. C.
Sp. Gr. for use	Optional
Solvent	V. M. & P. Naphtha

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IRVINGTON VARNISH & INSULATOR CO.
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New!

Kennametal Masonry Drill



**Cleans
Continuously**

ZIPS through cement,
brick, slate, marble

New trouble-free drill works
in any direction, goes to
any depth (up to 10 inches),
drills faster... can save
on time and cost.

New Kennametal "twist-type" masonry drill keeps drilling with no "time-out" for hole cleaning. Spiral flutes clean cuttings back as fast as they form. Drill operates easier, requires less power and push.

Super-tough Kennametal cemented carbide cutting edge resists wear, stays sharp — UP TO 100 TIMES AS LONG.

Buy Kennametal drills at your supply house.

**If your supply house
cannot supply you, write:**

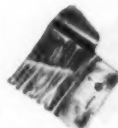
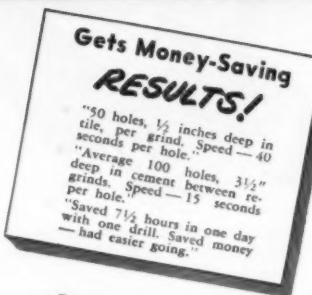
KENNAMETAL Inc., Latrobe, Pa.

Please send me FREE Kennametal Folder K-109 showing 26 different drill sizes, two different drill styles, and complete details on masonry drilling.

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Be set for any job with handy unit of assorted drill sizes. Kit holds 1/4", 5/16", 3/8", 1/2" and 9/16". Tough plastic case resists water and oil.



Convenient carton of six drills of one size keeps a sharp drill always handy. Drills lift as top opens.

KENNAMETAL®
WORLD'S LARGEST MANUFACTURER OF
CEMENTED CARBIDE DRILLING TOOLS

(93) **ELECTROSTATIC PRECIPITATION** for the control of small particles of matter, either liquid or solid, is discussed in 16-page 2-color bulletin GEA 5212. General Electric Co.

(94) **ROTARY SWITCHES** of snap, multi-pole design are subject of 12-page catalog 1950-P showing cut-away views, sub-assembly photographs, comparative-area sketches and dimensioned drawings. Electro Switch Corp.

(95) **AUTO AND INSULATED** transformers, open frame, cased, channel and end bell units from 0.01 to 300 kva, 25 to 400 cycles, 1, 2 and 3 phase, are discussed in file bulletin. Nothelfer Winding Laboratories.

(96) **LIFT TRUCKS**, with data and capacities of units from 500 to 15000 pounds, are presented in bulletin 26. Lewis-Shepard Products Inc.

(97) **VISIBLE OIL CUPS** with integral gages for use on bearings, transmission and crankshaft cases, are specified, priced and discussed in bulletin 31. Trico Fuse Mfg. Co.

(98) **SOLDERING GUN**, light weight, single pole, dual heat, high speed, is pictured, priced and discussed in 2-color bulletin. Caliri Mfg. Co., Inc.

(99) **SYNCHRONOUS** low-speed motors are presented in publication GEA 5332 with construction features, performance data and information on constant-speed, high-power-factor operation. General Electric Co.

(100) **LOOSE LEAF** bulletins present 378 models of lighting units, open and shielded, recessed and variously finished, complete with lighting plans and performances obtained. Northern Light Co.

(101) **MATERIALS HANDLING** with powered industrial trucks is illustrated and described in 4-page folder. Elwell-Parker Electric Co.

(102) **WIRING GUIDE** and catalog number 18 is pocket sized 112-page reference for complete line of raceway fittings. The Wiremold Co.

(103) **HOME COOLERS** in 3 sizes, multi speeds, rubber mounted, reversible fans, are priced, pictured and discussed in bulletin 347. Baldor Electric Co.

(104) **TRANSFORMERS**, oil-immersed and dry, self-cooled and forced-air types of many capacities and characteristics, are presented in 2-color bul-

letin 2001-150P-10M. Erie Electric Co., Inc.

(105) LIGHTING for banks and offices, using permaflexor fluorescent and incandescent equipment, is pictured and discussed in 2-color 16-page bulletin. Pittsburgh Reflector Co.

(106) CONDUIT FITTINGS such as locknuts, bushings, sill plates, entrance connectors, knockouts, entrance heads and clamps are listed by catalog number, size, quantity, shipping weights, by various leading manufacturers, permitting rapid caparison. Kwikon Co.

(107) PORTABLE POWER TOOLS are described in 3 circulars: JE-1148 giving data on $\frac{1}{2}$ and $\frac{3}{4}$ -inch drills and drill stands, JE-1139 describing sinker rock drills, and JE-1132 presenting 4 mining tools including a sinker leg, air bar feed, pneumatic column and stopper leg. Independent Pneumatic Tool Co.

(108) EXPLOSION-PROOF motors for Class I Group D and Class II Group F & G Bureau of Mines applications are described in 2-page file sheet. Reliance Electric and Engineering Co.

(109) TELEVISION equipment for industrial, research, commercial, scientific and educational use, enabling supervisory personnel to observe conditions in spaces classed as inaccessible, dangerous, distant, too small or too dark for direct observations, is presented in bulletin 1025. Diamond Power Specialty Corporation.

(110) SYNCHRONOUS GENERATORS, 12 $\frac{1}{2}$ to 1250 kva, are presented in bulletin GEA 5415 with text, photographs, and specifications. General Electric Co.

(111) DOOR OPERATOR for motorized, remote control operation of folding, swinging, sliding or overhead doors. Robot Appliances, Inc.

(112) VIBRATION isolators and mounting bases for airborne electronic equipment is discussed with diagrams, pictures, specification and text in catalog 502. The Barry Corp.

(113) GLASS JAR BATTERIES are discussed in 4-page presentation on unpacking, installation, charging, operation, inspection, records and care. Gould Storage Battery Corp.

(114) ELECTRICAL APPARATUS COMPUTER, called the Datarule, is described and illustrated in broadside. Useful in redesigning and checking of equipment. Brownell Distributors, Inc.

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*From Chapter X—National Electrical Code—3 conductors in conduit—40°C-104°F.

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Reader's Quiz

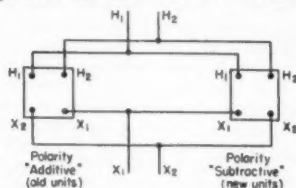
Transformer Polarity

QUESTION 343—Some time ago we purchased additional transformers. They are of subtractive polarity. All our old ones were additive polarity. At that time, I was told that they could not be grouped together unless they were changed internally.

I have asked several electrical engineers and they said they couldn't say for sure, but they thought they could be grouped together with the external connections.

Can they be grouped together externally or do they have to be reconnected internally?—A.T.

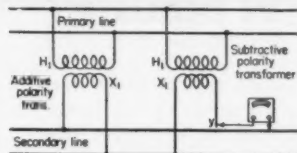
A. TO QUESTION 343—Regarding your question about paralleling a subtractive polarity transformer with your present additive units—it can and is done continually in practice. It is not necessary to touch the internal connections. This is the reason transformers are marked so—it obviates the necessity of concerning yourself with the internal connections.



From the limited amount of information given, I will presume your units are all single phase and the other requirements for paralleling are already met.

The diagram indicates the manner in which an additive and subtractive transformer unit is paralleled. It is merely a matter of matching similar markings. (If transformer units are not marked, you would first mark their polarity by the usual polarity test.)—E.A.M.

A. TO QUESTION 343—Single phase transformers of subtractive polarity can be grouped with those of additive polarity by making the proper external lead connections to the line. This is true for either single or 3-



phase service. The proper connections for single phase service are indicated in the sketch.

If the transformers are 3-phase units with the interphase connections made internally, the usual practice, then the internal connection of either the primary or secondary windings (not both) must be revised. In case the internal connections are to be changed, it is best to consult the manufacturer of the equipment for instructions.

Final check for correct connection may be made by leaving a secondary connection of the new transformer open at y and connect a voltmeter (or lamp bank) of suitable voltage range as indicated. With the line energized, and the connections made as shown, the voltmeter should indicate zero voltage. In case the voltmeter indicates double the secondary line voltage, reverse the secondary connections of the new transformer and recheck. Do not close connection at y unless voltmeter indicates approximately zero voltage.—H.A.W.

A. TO QUESTION 343—The polarity of a transformer is merely a term given to designate the arrangement in which the leads are brought out of the transformer.

Consider the high tension leads as "H1" and "H2", and the secondary leads as "X1" and "X2". Also, consider at the instant current is flowing in "H1", it is flowing out "X1". Looking at the top of the transformer with high tension terminals in back let "H1" and "H2" be the left and right hand leads respectively. Now in an additive polarity transformer, the secondary leads will be "X2" and "X1" left and right respectively; while in a subtractive polarity transformer, the secondary leads will be "X1" and "X2" left and right, respectively. Thus, an additive and subtractive polarity transformer may be used together (other conditions being satis-

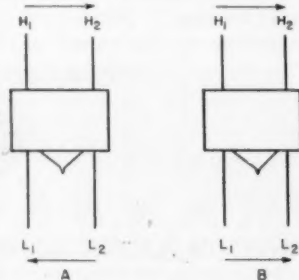
factory) merely by properly arranging the external connections. For example, if it is desired to parallel an additive and a subtractive polarity transformer, we would connect leads "H1" from both transformers to phase A, and both leads "H2" to phase B. Then leads "X1" of both transformers would be connected to one leg of the secondary feeder (even though the terminals are physically reversed) and both leads "X2" to the second leg of the secondary feeder.

Before closing secondary connections, it would be well to make the usual voltage checks across the secondary terminals.—W.E.T.

A. TO QUESTION 343—The polarity of a transformer is a convention for indicating the relative directions of the primary and secondary voltage vectors between the respective sets of external leads. The chief advantage of subtractive polarity, most important at high voltages, is the reduction in voltage stresses between adjacent primary and secondary external leads.

In the diagram, the internal construction of the transformers is such that will cause the secondary voltages L_1L_2 to take the directions shown when the high voltage vector H_1H_2 has the direction indicated. Transformer A is designated as additive. A connection between H_2 and L_2 would cause voltage H_1L_1 to be greater than H_1H_2 . With the same primary-secondary interconnection, Transformer B would be regarded as subtractive because the primary and secondary voltages are in opposition "around the circuit."

As they stand, the two transformers cannot be connected in parallel without causing a short-circuit condition. Like-

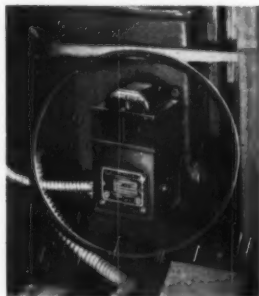
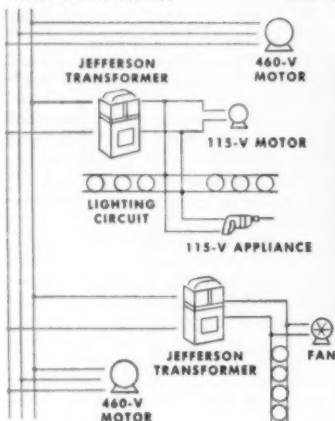


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wise, they will not operate together in an open delta connection without a serious voltage unbalance. However, if either pair of secondary leads is reversed, both transformers will "look alike" to any load. The reversal can be made internally or externally, as convenient. A reversal of either pair of primary leads will give the same result.

External reversal of leads is practicable in the ordinary run of transformers. External changes are not possible in polyphase transformers which have part of the wye or delta connections closed inside the tank. Also, external reversals are not advisable in single-phase transformers designed especially for grounded-neutral wye primary or secondary lines. Some makes of the latter transformers have either one primary or one secondary bushing designed to operate at little more than ground potential. Also, there may be complications in cases of built-in lightning arresters.

It is a good idea to test the polarity of any and all transformers before attempting to connect them in banks. With knowledge of polarity, voltage diagrams can be constructed which will give some indication of the success of proposed groupings.—L.E.B.

Compressor Motor Operation

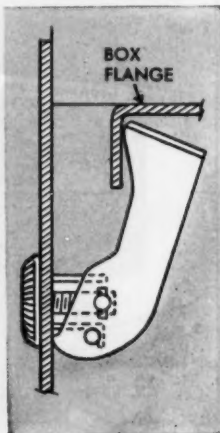
QUESTION 344—I have two ammonia compressors, now started in two steps by hand control, which I would like to change to automatic starting under load. A 5 in. by 5 in. compressor is driven by a 10 hp. motor. The compressor is 2-cylinder and turns 300 rpm. The motor is simple 3-phase induction. A 2-cylinder compressor turns 290 rpm., and is also driven by a 3-phase induction motor of 20 hp.

Since the motor torque is insufficient for cross-line starting, and unloading for starting is out of the question, what kind of controls would I need to start these units automatically under load?—G.H.

A. TO QUESTION 344—You can start an ammonia compressor automatically by using a high starting torque motor on condition that the compressor can take the heavy starting load. If the compressor was designed to work under unloaded conditions, which means a small size shaft, then you will have to use some kind of an unloading system such as 1 or more electric valves to act as an un-

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loader during the starting period. A timer can energize the valves. An ordinary 10 hp. induction 3 phase motor on the 80% tap during starting will develop 64% of its 160% starting torque or 102% starting torque, on the 65% tap it will develop 67% starting torque. A high starting torque motor can be obtained which will develop 290% starting torque and it will still be approved without a compensator. In this case, a thermostat controls a magnetic controller, and the magnetic controller controls the motor.—H.S.

A. TO QUESTION 344—I offer two comments in connection with your problem of starting the ammonia compressors. First, you indicate the motors are regular squirrel cage induction motors, but that "the motor torque is insufficient for cross-the-line starting". Normally, such a motor will have a greater torque with an increase of voltage. Cross-the-line starting would thus produce greater torque than the two step auto-transformer or other type of control you have been using, as essentially all the two-step starter does is reduce the voltage to the motor on the first step, and also reduce the current drawn by the motor during the initial starting period. If the surge of current with cross-line starting is not too great, then you should obtain good results by using regular cross-line full voltage magnetic starters controlled by such automatic means as you desire.

On the other hand, if two-step starting is really necessary, then any standard motor starter manufacturer can supply an automatic two-step motor starter. In either the cross-line or two-step method of starting, you would need some sort of device to initiate the motor starters. This device would be some sort of pressure switch or temperature controller, depending on what system you want to use. Usually a temperature element in a thermostat is the initiating device, although suction pressure, or some other pressure point is used to determine when the compressor should be started.—L.R.B.

A. TO QUESTION 344—Presumably, the type of hand starter used by G. H. at present is the ordinary hand-operated, reduced voltage compensator. The same starting characteristics may be secured for automatic starting by substituting an automatic reduced voltage compensator which may be obtained from several of the well known motor control manufacturers. With this type of starter, the motors may be started by push button stations or automatically controlled by pressure switches connected to the ammonia compressors.—R.W.H.

A. TO QUESTION 344—Automatic motor starters are the ones most commonly used for compressor motor operation and can be purchased from any motor control establishment handling motor equipment.

Two types of two step starters are available, namely the resistance type and the auto-transformer type.

Some power companies object to the auto-transformer type, due to the fact that there is a break in the circuit when changing from one step to the other.

Either type of starter can be operated automatically by connecting either a thermostat or a pressurestat in the control circuit of the starter. In case of pressurestat control, the practice is to install a dual pressurestat, the high pressure contacts wired to open the control circuit before a dangerous high pressure is reached and the low pressure contacts wired in the same control circuit to stop and start the compressor and maintain the desired temperature.

Usually, motors of the sizes mentioned are started across-the-line in which case the greatest starting torque is developed. This statement is contrary to a sentence in the question, but with a step starter, if the motor is started on the 75% tap, the starting torque will be only 56% of full value.

Take the matter up with the power company and see if the connected load is great enough to allow across-the-line starting, it all being dependent on whether or not the inrush current is higher than allowed in the particular district. The cost of across-the-line starters is much less than two step.

If the compressors are cooling the same area, the inrush current can be lowered by installing a time delay device in the control circuit to prevent both compressors from starting at the same time.—B.A.S.

A. TO QUESTION 344—The ammonia compressor motors Mr. G. H. writes about can be started automatically by replacing his present manual starters with an automatic reduced voltage time delay induction motor starter, which can be furnished by most manufacturers of motor controls.

These starters are equipped with motor driven or oil dash pot timers to hold the controller in the starting position for a predetermined time which can be varied.

He also stated that unloading these compressors for starting is out of the question.

To utilize the low torque induction motors to start the compressors, Mr. G. H. will have to devise a method to unload the machines within the system during the starting.

This can be done automatically by placing an ammonia check valve in

the discharge line to the condenser and putting a solenoid operated stop valve between the discharge and suction lines of the compressor making the connection in the discharge line before it reaches the check valve.

This solenoid valve will act in place of the manual operated by-pass or unloading valve used when starting the compressor under the present hookup.

This valve should have an area of at least $\frac{1}{2}$ the discharge pipe size and the solenoid should be strong enough to open the valve against any apparent pressure that remains in the discharge line after the machine has stopped.

This valve should be energized when the control is in the starting position and be de-energized in the running position. When this valve opens, the check valve holds back the high pressure gas in the condenser and the pressure above and below the piston will equalize and relieve the load the same as the manual by-pass.

Liquid lines to the evaporators should be equipped with solenoid valves to close while the plant is idle, to prevent flooding the system.

High pressure cutouts should be installed to stop compressors in event of cooling water failure of condensers.—A.B.V.

Can you ANSWER these QUESTIONS

QUESTION M16—We have several resistance welding machines that are provided with ignitron contactors and electronic heat controls. Sometimes we have trouble with these welders and after getting them back into operation we are not sure if the ignitron tube was the trouble or not.

Due to the expense of these tubes, we do not like to scrap them without knowing with some certainty that they are in bad order. We would appreciate very much any information as to some simple means with which we could test these tubes, and the equipment, such as meters and circuits we might need. We use both A & B ignitrons.—D.R.M.

QUESTION M16—If someone should connect a lamp between 1 lead of a 120-240 volt single phase system and 1 lead of a 3 phase 240 volt delta system, then a second person would connect a voltmeter between the remaining single phase lead and another 3 phase lead, would the voltmeter read about 416 volts for the combination open and closed delta connection?—H.S.

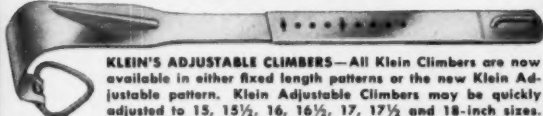
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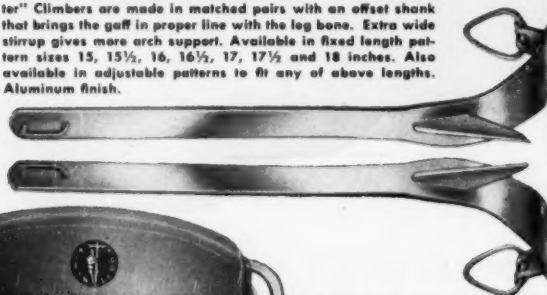
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Questions on the Code

Conductors

Q. *I was recently called for accepting type T insulated conductors for overhead runs between the house and garage. I find nothing in the Code one way or other concerning this and will be grateful for your help in quieting my critic.—A.P.B.*

A. The Code accepts type T for general use just as it has accepted type R and either can be used for an overhead span between the house and garage or other auxiliary building. In fact, several years ago Official Interpretation No. 282 covered this same problem and the Code Committee stated that a service drop might consist of types T, R or W.P.—G.R.

Recessed Lighting Fixtures

Q. *I have a customer now that refuses to let me go ahead on a recessed fixture job in his store because I told him I would have to place an outlet box in the ceiling alongside of each fixture and he feels it would ruin the appearance of the ceiling. I understand the Code requires it. Is that true?—L.M.Z.*

A. The N. E. Code does not make it necessary to use an exposed outlet box alongside of a fixture, it simply provides that as an alternate method. Under Section 4179 you will note the following:

"Conductors having insulation suitable for the temperatures encountered shall be used. Where conductor temperatures are in excess of 60 degrees C (140 degrees F), conductors shall be brought through at least four feet of metal raceway from the fixture to an outlet box at least one foot from the fixture. Such conductors, unless approved for the purpose, shall not extend a distance of more than six feet from the fixture as measured along the raceway."

If the temperature which can be expected within the recessed fixture is higher than the safe operating temperature of the insulation on the cir-

cuit conductors supplying the fixture, then it becomes necessary to use an outlet box located at some point not closer than one foot to the fixture with at least four feet of metal raceway between the outlet box and fixture. If an insulated wire suitable for use in raceway systems such as type AVA is used, the outlet box may be any distance from the fixture, even back at the point of distribution or, in other words, no outlet box would be necessary providing the fixture temperature did not exceed the rating for type AVA insulation. If you used type T insulated conductors for the circuit and chose to use an asbestos insulated fixture wire within the fixture, then the outlet box would have to be located at the end of not more than six feet of metal raceway from the fixture. This is true as the fixture wire has not been approved as a building wire and therefore is not to be used in raceway runs exceeding six feet in length.—G.R.

Feeder For Electric Range

Q. *In wiring a 25 kw 220 volt 3 phase electric range, what size should the feeder be and what would be the best grounding method, assuming the service is 3 wire, 3 phase? Also for a three phase 220 volt 3-wire service?—M.W.*

A. Note No. 2 under Table 29 of the Code states that ranges rated more than 21 kw are not considered as household ranges. Therefore they do not fall within the scope of Table 29.

The note further states that in general, the demand for such commercial ranges should be based on the maximum nameplate rating. Hence, the feeder for a 25 kw 220 volt three phase range should not be less than 4 No. 8 wires if some of the elements of the range are rated 110 volts or 3 No. 8 wires if all of the elements are for 220 volts.

The Code recognizes the grounding of a range to the grounded or neutral circuit conductor, if the system has

one, or if there is no grounded conductor, grounding the range to the metallic armor of a raceway or cable system or by means of a separate grounding conductor. For a range on a three phase 3-wire ungrounded system, it may be grounded to the metal armor of the raceway or by means of a separate grounding conductor to a suitable grounding electrode.—F.N.M.S.

Fittings

Q. *The question of using thin wall on 440 volt circuits is up here and we will appreciate your thoughts concerning Section 2574b, which requires double locknuts whenever the voltage exceeds 150 volts to ground. Fittings for thin wall do not have a thread long enough to use double locknuts. Therefore it seems as if we cannot use thin wall on 440 volt circuits.—A.S.N.*

A. You will note that section 2574 also states that electrical continuity of metallic raceways shall be assured by one of the methods specified in Section 2572 or by those specified under a or b of Section 2574. Then under Section 2572 you will find that permission is given to use any device approved for the purpose except ordinary locknuts and bushings. Therefore you may use electrical metallic tubing for 440 volt circuits provided you use bonding jumpers or bonding bushings around fittings which do not have sufficient thread to use a locknut on each side of the box or cabinet and where two sections of the tubing are being fastened together, any approved threadless coupling made up tight is acceptable.—G.R.

Receptacle Outlet

Q. *On several recent farm jobs the owners have wanted receptacle outlets at the pole in the yard so they can plug in trouble lamps and electric tools under the yard light. I have always in the past removed a knockout from the bottom of the*



Peerless Electric

TYPE PVS EXHAUST FANS

FEATURES

ALL-PEERLESS ELECTRIC UNITS—These fans are completely designed and manufactured by The

Peerless Electric Company, a manufacturer of fans and motors since 1893. Both the motor and fan are designed to work together as a unit. This assures quiet operation and full rated output.

CAPACITOR MOTOR—Permanent split capacitor type using no internal switches or mechanical parts to fail and cause breakdowns. Totally enclosed to exclude all dirt and moisture drawn over the motor. Highest quality material available used on all parts for a trouble-free motor.

QUIET OPERATION—Wide heavy gauge steel blades rotating at slow speed to assure rated capacity at low noise level.

HORIZONTAL OR VERTICAL MOUNTING—Fans may be mounted in either position. Ball bearing in rear hood to take end thrust in all positions. Easy to lubricate and service.

FURNISHED COMPLETE—Controller for single speed, two-speed, or three-speed furnished with unit as ordered. No other switches or starting equipment required.

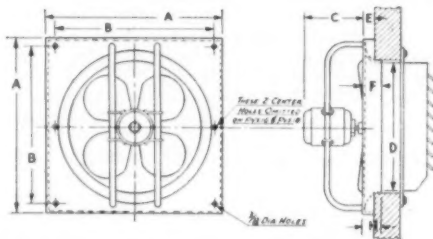
EASY TO INSTALL—Requires only 4 or 6 lag screws or bolts to mount. Opening may be round or rectangular—panel will cover all irregularities of cut opening.

GUARDS AVAILABLE—Neat appearing, protective guards for inlet side to eliminate hazards are available for all units.

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GUARANTEE—Peerless Electric Fans and Motors are guaranteed against defective workmanship or material for a period of one year from date of shipment from factory. Each unit, when shipped, is registered and the serial number identifies it immediately for spare parts or duplicates.



Model	Fan Diameter	Capacity C.F.M.	Motor H.P.	R.P.M. High	Recommended Shutter Size	FAN PERFORMANCE AND DIMENSIONS						Shipping Wt.
						A	B	C	D	E	F	
PVS-16	16"	2150	1/8	1100	16"	24	22 1/4	8 1/2	16 1/2	1 1/4	2 1/2	55
PVS-18	18"	2900	1/6	1100	18"	26	24 1/2	12	18 1/2	1 1/4	3	75
PVS-24	24"	4550	1/4	890	24"	34	31 1/2	12 1/2	24 1/2	1 1/4	3 1/2	90
PVS-30	30"	7375	1/2	660	30"	40	37 1/2	13 1/2	30 1/2	1 1/4	3 1/2	145

THE *Peerless Electric* COMPANY
WARREN, OHIO

switch cabinet on the pole and have mounted a sign receptacle within the cabinet above the opening so a plug fuse may be inserted without removing the dead front. I then can supply a weatherproof receptacle from one of the switch load terminals and have it protected by a 15 ampere fuse. Recently the inspector asked me to remove these sign receptacles and provide an additional enclosure containing the necessary fuse cutout base. Is that required by Code or is it just a personal idea?—J.P.R.

A. In the first place the usual sign receptacle cannot be used as a plug fuse holder as it is not designed for such use. The sign receptacle is limited to 660 watts at 250 volts while a plug fuse holder is designed to carry at least 15 amperes. Then in addition, many switch cabinets do not contain sufficient space to permit the addition of a plug fuse holder within the wiring space of the cabinet. In fact, the N. E. Code even prohibits the splicing of conductors within the switch enclosures unless the cabinet in question contains special wireways designed for such purposes. Therefore your inspector was justified in requesting that you remove the sign receptacle and provide the additional enclosure to house a standard plug fuse holder.—G.R.

Type AVA Wires For Service Work

Q. I would like to know if Type AVA wires are usable in respect to the Code for service entrances? In other words, could I use 3 No. 8 AVA conductors in 3/4 inch conduit from service head to meter and then to a 60 amp. service switch, the maximum length being 12 inches?—L.E.V.

A. Type AVA wires are approved for use in dry locations only. Service standpipes do breathe and in foggy and humid weather, tend to draw in moisture.

While Section 3102, paragraph b of the Code requires that conductors used where condensation or accumulation of moisture within a raceway, is likely to occur, shall be of the moisture-resistant type of lead covered, the rules for service do not cover this point but Section 2336 requires that the service head shall be raintight and that a service raceway shall be raintight and arranged to drain.

The local inspection authorities should be consulted as to their ruling on this matter.

If it is decided to use AVA wires in such a location, 3 No. 8 AVA may be run in a 3/4 inch conduit.—F.N.M.S.

NOW more wiring room

FOR

LOCKNUTS, BUSHINGS, SPLICES

WITH THE

NEW P&S BOX COVER SWITCHES



P&S 1141 (4-INCH)

Available in Single Pole and Three-Way
All switches have positive kick-offs — arc-snuffers — pre-loaded contacts. Longer life, smoother operation and exceptional current carrying capacity assured. Non-T-rated switches are made of brown bakelite — T-rated switches made of black bakelite — Oil Burner switches of red bakelite.

Approved by Underwriters' Laboratories.

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Don't order "a box cover switch" — specify "the new, easy-to-install P&S box cover switch."

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SYRACUSE 9, NEW YORK

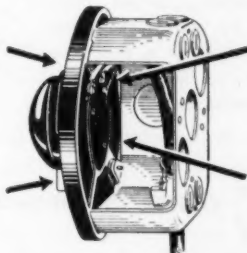
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Full 10 Amp., 125 Volt Rating

LOOK AT THESE REAL IMPROVEMENTS IN DESIGN

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housing — serves
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Terminals ample
for No. 12 wire

Handle in
protected position
— operates
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Flush back leaves
entire box free for
splices, locknuts
and bushings

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FOR ALL MASONRY

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Arro "Flexo-Flute" Spin Drills go the full depth without packing or stalling. The permanently attached low-angle flexible spring cleans drill cuttings from hole automatically.

Cutting Tip is made of cemented carbide, hardest metal made by man. The "Flexo-Flute" drills up to four times faster . . . lasts many times longer than ordinary drills. Yet

they cost no more than plain round shank carbide drills!

Holes are cleaner, truer and drilled faster with much less pressure.

Let Arro "Flexo-Flute" Spin Drills save you both time and money in your masonry work.

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NO. 8
TOGGLE
BOLT



STUD BOLT
ANCHOR
1/4" - 1/2"



MACHINE
SCREW
1/4" - 3/8"

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MARION • OHIO

Dusty Locations

Q. In a woodworking plant here they are installing several hydraulic presses on which they plan to make wall boards from sawdust and resin. The shavings and waste ends of lumber pass through a machine that shreds the wood which is then mixed with ordinary sawdust. This wood refuse is then sprayed with a resin and pressed into boards. Will the room in which this operation is conducted be a dusty location and require the use of Class 2 electrical equipment?—M.A.D.

A. This would definitely be considered a Class 3 location and possibly even Class 2. However, each such operation often presents problems which must be individually considered. If the sawdust used contains no material which will pass an 80 mesh screen, there is practically no likelihood of a dust cloud forming from a shredding mill or waste hog, and the area then would be considered as Class 3. If, on the other hand, the wood refuse contained an appreciable amount of fine particles that would pass an 80 or 100 mesh screen, it is possible the area should be considered as Class 2. In either case it will not alter the type of electrical installation greatly as Class 3 requirements call for rigid conduit, dust-tight fixtures and switches and totally enclosed fan cooled or pipe ventilated motors.—G.R.

Conductors

Q. Does the Code allow the use of bare copper as an underground neutral conductor? We are going to install some outdoor lighting and want to run USE conductors for the hot wires and bare copper for the neutral.—H. P.

A. The Code does not state bare copper conductors shall not be so used except that under Section 300.3 you will note the N. E. Code states conductors must be protected against corrosion. Some soils contain chemicals which rapidly corrode copper. Therefore many electrical inspection authorities prohibit the use of bare copper neutrals for direct burial in the earth unless tests have indicated the soil does not contain harmful chemicals. Well drained sandy soil usually is free of these corroding agents and dry soil under paving is nearly always safe, but in all other types of soil conditions it is well to use Type USE conductors for the neutral unless actual soil analysis indicates there is no danger of corrosion.—G.R.

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NEOPRENE SHEATH

FLAME RESISTANT
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Developed for the farm ... proved on the farm ... RoBarn is ideal for general purpose wiring where hazardous conditions exist. It is Underwriters' approved as Non-Metallic Sheathed Cable having "adequate fungus resistant and other necessary properties for use in cow barns and other locations where it would be subject to conditions of heat, cold, moisture, corrosive fumes and fungus."

RoBarn has many applications and can be used under rules of the National Electrical Code, Article 336. With RoBarn on the job you eliminate the hazards of fire, moisture and extreme temperature changes.

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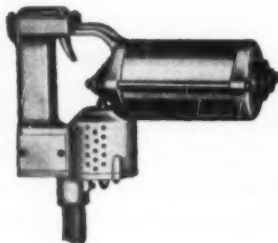


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3600 powerful blows per minute from one working part—the PISTON

Five different models — all small in size yet big in power.

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CONTRACTOR B. H. Barge (right) of Milwaukee discusses Uskon ceiling installation technique with J. W. Hogan, U. S. Rubber Company representative in Milwaukee.

Commercial Cooking

The following letter from H. H. Watson, Chairman of Code Making Panel No. 2 relates to a discussion of commercial cooking equipment under Code questions in the February 1950 issue of *Electrical Construction and Maintenance*:

"Mr. Rowell states in his discussion that the term 'other cooking appliances' includes restaurant equipment. He is correct in the statement that commercial cooking equipment should not be included. It is my contention, however, that the Code is specific on the point that Table 29 does not include commercial cooking equipment. Note 2 to Table 29 instructs that commercial ranges should be included in calculations at the maximum nameplate rating of the range. Also Section 2116-b requires that outlets be provided for specific appliances at the ampere rating of the appliance with the exception only of household electric ranges (Section 2116-c-1).

"In outlining the requirements for feeder capacity which is essentially the sum of the capacities of all branch circuit loads, exceptions are made in Section 2203-d and (e) for non-commercial equipment only. Paragraph (d) refers to Table 29 which contains the note on commercial cooking. Paragraph (e) is specifically limited to dwellings.

"In the 1940 Code, Table 29 is headed 'Demand Factor for Household Electric Ranges.' Also in the 1940 Code in Paragraph 2203-c, Table 29 is the reference table for demand factor for loads consisting of 'household electric ranges and other household cooking and baking appliances'.

"I am in full agreement with Mr. Rowell that commercial equipment should not be provided with feeders or branch circuits based on Table 29, but I wish to call attention to the fact that a close reading of the 1947 Code and a consideration of the 1940 Code do not indicate, as Mr. Rowell states, that Table 29 includes commercial cooking equipment. It is apparent that there is probability of confusion with the present wording of the Code, and I am adding this matter to the docket of Code-Making Panel No. 2."

Official NEC Interpretations

INTERPRETATION NO. 347

Issued December 23, 1949

Section 5021

Flexible Cords, Class 1, Divisions 1 and 2

STATEMENT: A motor-operated appliance requires a flexible connection between the motor and its controller mounted on a common base. The appliance is intended for use in Class I, Group D hazardous locations, the motor and starter being of explosion-resisting types.

QUESTION: May a flexible connection employing a Type S or Type SO flexible cord enclosed in standard flexible conduit with special fittings at the cord terminals and special bushings at the conduit terminals, constituting an assembly designed to meet the intent of section 5021, be used under the foregoing conditions?

ANSWER: No, section 5021 applies strictly to portable devices, such as portable lamps or appliances, where the use of explosion-proof flexible conduit is not practicable.

ARTICLE 250—GROUNDING INTERPRETATION NO. 350

Issued March 6, 1950

Section 2571—c—2598

Service Grounding Conductors

STATEMENT: A rigid conduit enclosing branch circuit conductors runs from the service equipment to a point near the grounding electrode.

QUESTION 1: Is it the intent of section 2598 of the 1947 National Electrical Code to permit the service grounding conductor to run through rigid conduit and one or more outlet boxes, enclosing branch circuit conductors to a point near the system grounding electrode, when such a service is supplied by an overhead distribution system?

ANSWER: Yes.

QUESTION 2: Is it the intent of section 2571-c, that all rigid conduit raceways enclosing the system grounding conductor be bonded?

ANSWER: No. This paragraph applies when the conduit itself is the grounding conductor as permitted in section 2592.

Dependable Action

Positive Protection

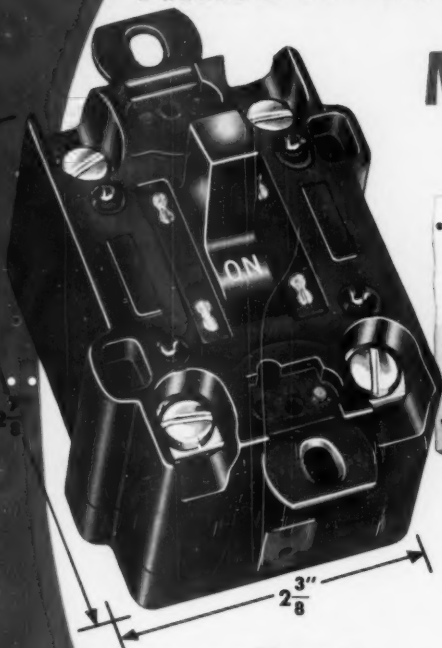
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MANUAL STARTERS

For AC or DC MOTOR CONTROL



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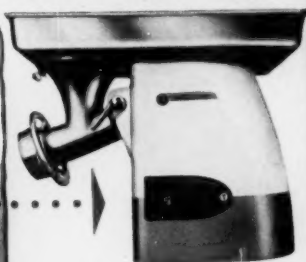
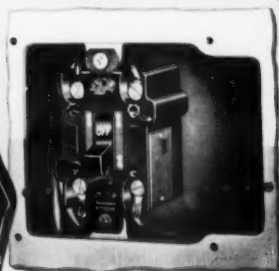
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"LOAD-LIMIT" STARTERS FOR:

SMALL SIZE: 2 3/8" x 2 3/8" x 2 1/8"

FLUSH MOUNTING: Compact. No projecting parts.

EASY WIRING: Plenty of room for quick, easy hook-up.

COMPLETE PROTECTION: Both operator and machine protected against overload.



THOUSANDS IN CONSTANT DAILY USE!

Yes, over 100,000 Arrow-Hart "LOAD-LIMIT" Starters have been sold to satisfied customers who keep coming back for more. Why? Because these starters are suitable for both AC or DC applications — are easy to install and maintain. The full range of interchangeable heaters, the trip-free operating lever and dependable make-and-break save time and money usually lost through shut-downs. Because flexibility and rugged construction are built into these starters, you can control 2 motors from 1 point-of-control — with minimum installation time and maximum economy of wiring and maintenance. Wall box mounting and plate screw spacings are standard.

The A-H "LOAD-LIMIT" Manual Starter is made in types to suit many application requirements — in 2-, 3- and 4-pole models, in ranges to give thermal overload protection to motors rated up to 5 H. P., single and polyphase through 440 Volts AC and 2 H. P., 230 Volts DC.

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FOR *Outstanding*
PERFORMANCE



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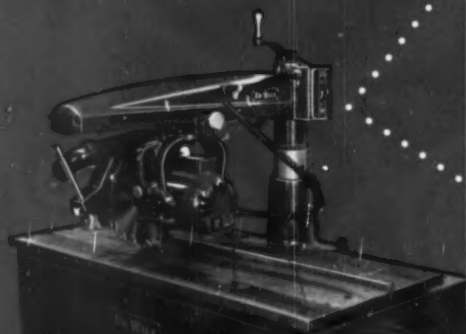
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MANUAL STARTERS WITH THERMAL OVERLOAD PROTECTION FOR SUPERIOR PERFORMANCE FOR AC or DC MOTOR CONTROL

Ruggedness, long life and dependability are built into every A-H "LOAD-LIMIT" Manual Starter — to give you maximum motor control efficiency and performance. Every component is designed to serve the most exacting requirements. Their ease of installation, operation and maintenance warrants your consideration if you're looking for quality, economy and flexibility in the motor controls you specify, buy or use. Watertight, dust-tight and explosionproof models are available for AC or DC.

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IN ANOTHER INSTANCE
DE WALT USES A-H
"LOAD-LIMIT" STARTERS FOR:

SMALL UNIT SIZE
SURFACE MOUNTING: Handy, easily accessible.

EASY WIRING: Plenty of room for hook-up and service.

COMPLETE PROTECTION: Operator, machine and work are given protection against overload.

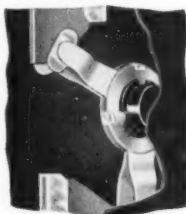
EASY TO WIRE ... TO SERVICE

There's plenty of room in the unit for quick, easy wiring and maintenance. Large terminal screws and snap-on back save time in installation and servicing.



DEPENDABLE ACTION

Full-floating, self-aligning movable contacts are laminated for smooth, positive action and spring-clip contact pressure. Molded hub is fully insulated; casing is high impact Bakelite with individual arc-damping chambers.



POSITIVE PROTECTION



Here's positive overload response! Overcenter positive trigger and latch gives dependable tripping. Pushing lever to OFF relatches for reset.

FLUSH MOUNTING

One case is used for all sizes of units. Spring-mounting screws permit flexible automatic adjustment to any front A or back-of-panel B thickness up to 1/2".



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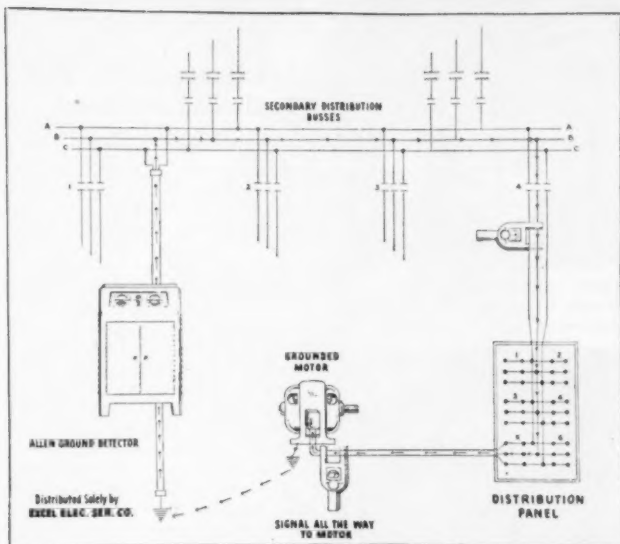
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Practical Methods



PULSATING SIGNAL CURRENT flows through grounded phase from signal generator through secondary distribution buses to panel sub-feeder; through panel and grounded branch circuit to ground, fault at motor; then back through ground path to signal generator. Hand receiver instrument picks up signal and gives pulsating meter indication until point of fault where needle remains stationary.

Ground Detector Cuts Maintenance Costs

MAINTENANCE

Because a maintenance electrician had an inventive type of mind, electrical maintenance costs have been slashed at the Tractor Works Division of International Harvester Company in Chicago. Works management estimates a \$15,000 yearly saving due to reduction in time required to locate electrical system grounds; also the resultant reduction in equipment repairs and possible production interruption due to clearing grounds before damage occurs.

About a year ago the general foreman of the Tractor Works electrical department, plagued by excessive time and costs in running down grounds on their 440-volt, 3-phase distribution system, asked electrician C. D. Allen if anything could be done to simplify this chore. Allen's answer was the development of a ground detecting apparatus that would permit detection and location of grounds in a matter of minutes while the circuits were "hot" and all equipment was in operation.

Formerly, the technique for locating grounds on the isolated (ungrounded)

electrical system was to shut down circuits one by one until the grounded circuit was found. Then came the laborious chore of definitely locating the actual point of ground fault in that specific circuit. This might take hours—or even days—for a team of electricians to find the fault point. Typical of the advantages gained by Allen's apparatus was the case of ground occurring at the Tractor Works plant. The point of ground fault, several hundred feet from the main switchboard room where the detector was installed, was detected and located within 12 minutes. Step by step technique is illustrated by the accompanying photographs.

The new apparatus, known as the Allen Ground Detector, consists of a Signal Generator and a hand Signal Receiver similar to the clamp-on ammeter. The signal generator superimposes a low-voltage pulsating (50 times per minute), alternating signal current on the grounded phase conductor. This signal current, up to 22 amperes maxi-

mum, flows through the grounded conductor to point of ground fault, then back to the signal generator through ground path. The actual fault point is traced and located by passing the super-sensitive hand receiver instrument along the feeders, distribution cabinets and branch circuits to the equipment. A microammeter in the receiver picks up the signal current and gives a pulsating indication until the fault is reached. At the point of fault, where the signal current returns to the generator through ground path, the needle on the microammeter remains stationary.

The grounded phase is first detected by a voltmeter with phase selector switch on the signal generator control panel. Other accessories include a meter to register signal current; a test button to indicate ground intensity; an "Off-Automatic" switch to control the automatic impulse signal; and a pilot light. Control circuit for the automatic signal generator operates on 115-volts, single-phase, 60 cycles. The cabinet housing signal generator has double-door storage space for hand receiver and other items.

Now on the market, the apparatus (patent pending) is made by the Ferr Manufacturing Co., Inc., Chicago and distributed by Excel Electric Service Company in Chicago. The unit illustrated is permanently installed through a 30 ampere, fusible switch adjacent to the main switchboard in the plant substation. Overall cabinet dimensions



AFTER GROUNDED PHASE is indicated on cabinet meter, the control switch is turned to automatic operation and pulsating signal current goes out over grounded conductor.

SAVE

with an Oster
"PIPE MASTER"

Save on first cost! Save on upkeep cost! But most important—**SAVE TIME** threading pipe and bolts with one or more of these modern "PIPE MASTER" threading machines. All have standard range $\frac{1}{4}$ " to 2" pipe; Extra range $\frac{1}{8}$ " pipe; Range with drive shaft $2\frac{1}{2}$ " to 8" pipe; Bolt range $\frac{1}{4}$ " to $1\frac{1}{2}$ ".



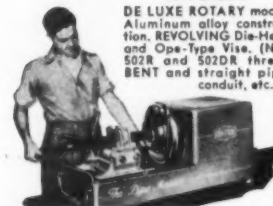
No. 502
STANDARD model. Steel construction. STATIONARY Die-Head. "SPINFAST" front chuck.



No. 502R
STANDARD ROTARY model. Steel construction. REVOLVING Die-Head and Open-Type Vise.



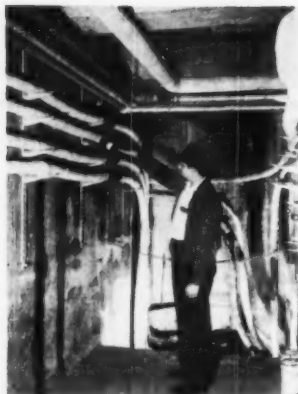
No. 502D
DELUXE model. ALUMINUM alloy construction. STATIONARY Die-Head. "SPINFAST" front chuck.



No. 502DR
DELUXE ROTARY model. Aluminum alloy construction. REVOLVING Die-Head and Open-Type Vise. (Nos. 502R and 502DR thread BENT and straight pipe, conduit, etc.)

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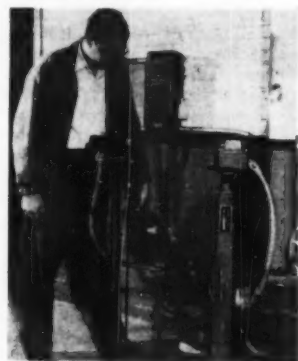
OSTER



THEN THE ELECTRICIAN traces ground by passing hand receiver instrument along feeder cables . . .



TO DISTRIBUTION CABINET where pulsating indication on instrument meter leads him to grounded branch circuit. Continued pulsation of meter needle leads him . . .



ALONG GROUNDED branch circuit to sump pump motor where needle remains stationary indicating point of ground fault. Total elapsed tracing time from ground detector to motor was 12 minutes.

are: 20-in. wide; 16-in. deep and 35-in. high. A portable model, for use in plants with numerous unit substations, is $\frac{1}{2}$ -in. higher, with other dimensions the same; is equipped with handle, wheels and necessary connecting cords.

Job Improved By New Tools and Methods

TOOL

The Refined Products Corporation in Lyndhurst, N. J., manufacturing textile detergents, is representative of thousands of excellent jobs around the country. By today's yardstick it isn't large, yet it is an example of good construction (electrically, mechanically and structurally) aided by the use of modern tools and equipment.

Many of these methods and tools are evident in the accompanying illustrations, for we can note the use of lightweight scaffolding, easily assembled and equipped with ample working platforms, protective guard rails and ship ladders for added safety. Mounted on casters, the scaffold can either be propelled around the floor or locked in position for added rigidity. And, since the platform moves freely with little manual effort necessary, the electrician can guide its direction and movement from above, by pressing on girders or structural beams. This eliminates the necessity for him descending each time the working position is shifted. As pictured, the platform is ample to hold tools and equipment, and additional tools can be conveniently and safely carried in the linesman's belt worn by the electrician pictured, Larry Feeley.

In the same picture can be seen busduct for power distribution with minimum voltage drop, suspended from roof girders at frequent intervals and also supported from the upright structural columns. The control panel beneath it makes control convenient and exact, for panels are located within sight of the machines they control and engineers can observe the reaction of equipment when they activate switches.

Other approved practices are shown in the second picture, for the electric threader is positioned at a comfortable working height, means for liberal lubrication is available and a bracing arm relieves manual strain from the arm of the operator.

While the plant has a connected load of only 200-hp. and a lighting load of only 45-kw., provision for future expansion and insurance against overloads is evidenced by liberally-sized service feeders, main switchgear and control panels. Safety breakers, switches and fuses give circuit protection at multiple points, and grounding

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Sturdy, adjustable Unistrut channel and fittings were used in this large midwestern bank to support, suspend and align 249 slimline fixtures and 20 spot lights. Here is how it was done: Unistrut channel attached to the ceiling and mounted on the fixtures was connected by hanger rods spaced on 18-ft. centers.

Result is a good looking, completely safe installation with all rows of units perfectly aligned and supported, fewer hangers and fittings required, and substantial time and money saved on the job. Photo below illustrates continuous fixture run suspended wholly by Unistrut framework attached to columns and walls.



Unistrut is metal channel with a continuous slot. You simply insert the Unistrut spring nut into the channel at approximate point where attachment of another framing member, hanger or fitting is desired, slide to exact position and bolt tightly in place. No drilling, no welding, no special tools or equipment required.

Try Unistrut on your next fluorescent lighting job—prove that it saves time, cuts costs—that it's fast and easy to install, no matter how difficult or complicated the job. Unistrut is trim framework, provides great strength without bulk and lasts indefinitely. You can support fluorescent fixtures better with Unistrut!



The World's Most Flexible
All-Purpose Metal Framing

**FULLY TESTED AND PROVED BY CONTRACTORS
ON THOUSANDS OF INSTALLATIONS
DEMANDING THE FINEST IN LIGHTING.**

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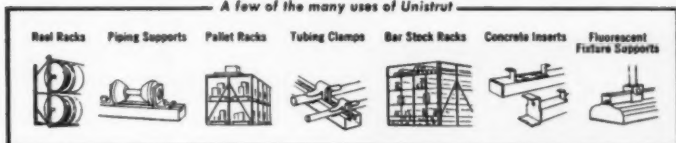
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Company

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City Zone State

A few of the many uses of Unistrut



Build BETTER PERFORMANCE GREATER PROFIT into every job

CONTRACTORS:

When you build a G-E time switch into any electrical installation, you build extra convenience, economy, and safety for your customer—added profit for yourself.



TIME SWITCHES

Every electric circuit requiring repetitive on-off control needs *automatic* control by a G-E time switch. Take a look at these applications. Have you considered them all? Have you pointed them out to your customers? There are benefits in each for both you and your customers.

There's a G-E switch to handle any of these jobs or any special application that may exist on the job you're handling right now.

QUALITY BUILT— EASY TO INSTALL

Both switches feature large silver contacts and the ever-reliable, permanently lubricated Telechron® motor. Roomy wiring space, simple knockouts, and a mechanism that is easily removed from its case make installations a snap.

Better put G-E time switches on your check list for every job. You can get them from your local G-E distributor. And if you want more details, write for bulletins GEC-535 (T-27) and GEC-578 (T-47). Apparatus Dept., General Electric Company, Schenectady 5, N. Y.



Type T-47 Handy Time Switch. For circuits requiring one ON-OFF operation every 24 hours. Handles ON periods from five minutes to 22 hours. Only \$10.98 list.

- Store-window lighting
- Electric-sign control
- Refrigeration defrosting
- Electric-appliance control
- Apartment-hall lighting
- Factory-yard lighting
- Heater and cooling control
- Public building lights
- Conveyor, fan, solder-pot, or oven control in factories.



Type T-27 is the switch for almost any job. Performs up to 12 ON-OFF operations during any 24 hours. Available with astronomic dial or day-omitting device if desired. From \$25.50 list.



LIGHT WEIGHT SCAFFOLD can be easily erected and propelled. Platforms, guard rails and ladders are safety features. Lineman's belt is useful for carrying small tools.



ELECTRIC PIPE THREADER conserves manual effort and, together with hydraulic benders and other tools using principles having mechanical advantage, speeds installation procedures.

of circuits and equipment is thorough. High-level illumination is uniform in offices, manufacturing areas and shipping sections alike. Busduct power distribution promotes flexibility of plant layout and increases motor efficiency. Lighting and motors are controlled from more than a single location, all conveniently located. Wiring throughout the plant is 12-gauge or larger. Panel gutters are oversized for connection facility. And dozens of plant operations are motorized, activated by automatic controls.

The plant also reveals the results of fine workmanship, high standards and

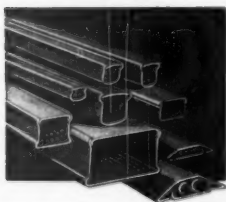
GENERAL  ELECTRIC

603.104



By 1965 (or sooner) there will be a common complaint

A new home . . . a new skyscraper. Very little in common, you might say, but unless the plans called for *adequate wiring*, chances are there will be a common complaint. The housewife with a new toaster in her kitchen, the office manager with a new electric typewriter in his stenographic department . . . both have a right to expect wiring that will not only meet present requirements of electrical service but wiring that can be quickly, easily extended to meet future needs as well. The wide-awake contractor who works with Wiremold knows from his own experience that with nine interconnecting surface raceway systems, each complete with a minimum number of fittings . . . Wiremold is always the answer! Write for facts that will help you plan Wiremold on *your* next job.



Know your **WIREMOLD**

THE WIREMOLD COMPANY
BARTHOLOMEW, N.J.



GREENLEE HYDRAULIC BENDERS ON THE JOB AT GRAND COULEE DAM HELP SPEED CONDUIT INSTALLATIONS

Quick, easy set-up and swift, accurate performance are just two of the many reasons why United States Bureau of Reclamation workmen prefer the GREENLEE for on-the-job bending of conduit and pipe at Grand Coulee Dam.

On your conduit installations you, too, will find that the GREENLEE brings you important time and material savings... makes the job go faster and easier.

For, whether power driven, as shown above, or hand pumped, the GREENLEE is easily operated by *one man*. Makes precise neat bends in just a few minutes in rigid and *thin-wall* conduit or pipe

up to 4½", tubing, bus-bars. Compact, portable... easy to set up and operate exactly when and where you want to... *right on the job.*

And the GREENLEE eliminates cost of many manufactured bends and fittings, cuts job time to a fraction.

Get facts today... see why many owners find that the GREENLEE Hydraulic Bender often pays for itself on the first few jobs. Write for free booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1744 Columbia Avenue, Rockford, Illinois, U. S. A.



OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Knockout Tools • Auger Bits and Drills

modern construction methods; placing the job definitely in an approved category. Equipment is installed with surveyor accuracy. Connections are precise and positive. Minor though these details may be, they indicate know-how properly applied, an artisan's pride in a well done job, and the value of using modern tools and equipment which, in this case, included hydraulic benders, electric drills, power-driven pipe threaders and cutters, chain hoists, drill presses and aluminum rolling scaffolds. This equipment indicates selection with a purpose and application with understanding.

Convenient Holder For Fish Tape

—WIRING

A convenient holder for a length of fish tape can be made from a couple of feet of flexible metallic conduit, cut squarely across the ends and filed free



**FLEXIBLE METALLIC CONDUIT
makes excellent holder for fish
tape.**

of burrs and sharp edges. In use, the tape is unreel as required, simply by sliding the flexible conduit around the coil of tape. When the tape is to be again rolled, the flexible conduit is moved around the coil in the reverse direction.

Storage Batteries Replaced Without Interrupting Service

—MAINTENANCE

From time to time it becomes necessary to install new standby storage batteries. This can be done by following the recommendations of the Laboratories of the Gould Storage Battery Corporation, Depew, N. Y.

Step 1 shows two sets of 12 cells, the shaded cells representing the new battery to be installed. In the top row,

NOCRETE
WITHOUT CONCRETE
ENCASEMENT

Orangeburg Fibre

STANDARD
WITH CONCRETE
ENCASEMENT

CONDUIT NEWS

MORE BUSINESS — MORE PROFITS FOR THE CONTRACTOR

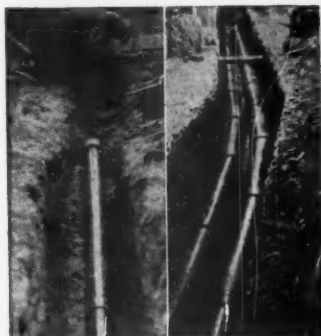
VOL. 1 NO. 2

APRIL 1950

★★★★★

LEADER AND FIRST CHOICE IN EVERY CITY AND STATE!

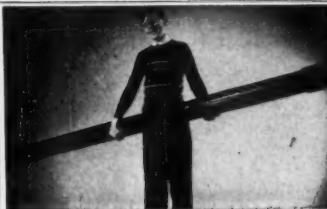
NOCRETE for One and Two Duct Installations



For single or double duct runs, ORANGE-BURG NOCRETE (Type 2) is the *ideal* conduit. Made with heavier walls for installations *without* concrete encasement, *Nocrete* makes possible valuable savings on such installations as—factories, schools, colleges, hospitals, drive-in theatres, power, telephone and other communications systems—also service entrance, parkway and suburban lighting, airport lighting and communication.

**NOW BRANDED
WITH
ORANGEBURG
TRADEMARK**

DISTRIBUTED BY
Graybar
ELECTRIC COMPANY



LIGHT, EASY TO HANDLE

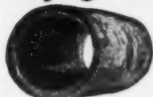
...and *more workable*. That's why Orangeburg Fibre Conduit is a big help in lowering transportation costs and speeding installation.



CUT AND WORKED ON JOB

Orangeburg can be cut with rough tooth hand saw -- drilled or worked with ordinary hand-working tools.

Time Defying Materials



Unretouched photograph of Orangeburg material removed from ground after 41 years. Orangeburg withstands ground waters, acids, oils and alkalis.

MORE ORANGEBURG AVAILABLE

...at *more* distribution points through Graybar Electric Company and General Electric Supply Corporation.

ORANGEBURG KEEPS FORGING AHEAD

North, south, east and west Orangeburg Fibre Conduit is the first choice of leading utilities and municipalities, many contractors and practically all design engineers. Orangeburg innovated all the important advancements of the fibre conduit industry—another reason why it's the leader.

When the installation requires duct-banks of four or more ducts, ORANGEBURG STANDARD (Type 1)—installed *with* concrete encasement—is the *preferred* conduit.



JUST A TAP OR TWO

Tapered Sleeve Couplings save a lot of time for the Contractor. A few light taps on the coupling drive it firmly against the shoulder of the conduit. This makes a permanently tight, infiltration-proof joint.



Send for Bend Section Folder

Conduit-line transformation problems like this are greatly simplified by Orangeburg Bend Sections. Illustrated folder—showing various types of Orangeburg Bend Sections and Angle Couplings, their specifications, advantages and applications—sent **FREE** on request. Write today to Dept. EC-4, Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

DISTRIBUTED BY

GENERAL ELECTRIC
SUPPLY CORPORATION

ORANGEBURG MANUFACTURING CO., INC., ORANGEBURG, NEW YORK

It's the RIGHT ANGLE for Tough Spots...Faster Jobs BIGGER PROFITS



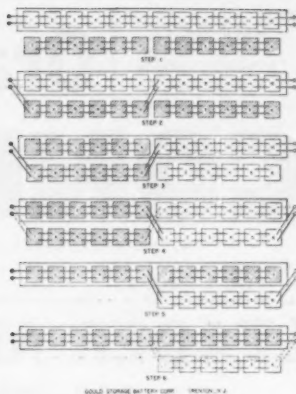
UNMATCHED for accuracy, time-saving, and speedy performance in close quarters, this remarkable new tri-speed HOLE-SHOOTER is the choice of electricians everywhere and a sure profit-builder for electrical contractors. It has no equal for speeding-up construction work and maintenance in industrial plants.

Adaptable to easy, usable positions, even in the tightest corners, this tool provides the most suitable speeds for boring with bits of every size, including expansive bits and hole-saws. Also suitable for drilling in steel and concrete.

See Your Wholesaler

If he cannot supply you, write us direct and mention his name. "You'll buy if you'll try".

MILWAUKEE ELECTRIC TOOL CORP.
5352 W. State Street, Milwaukee 8, Wisconsin



STANDBY STORAGE BATTERY
is replaced by new 12-cell unit without breaking the circuit by shifting connections and batteries in accordance with the above sketch.

the old battery is completely connected to the circuit and the new battery is connected in groups of six cells each. This gives an opportunity to inspect the new cells thoroughly before disturbing the old circuit. By tying the new cells together, it can be determined whether the cells are in good condition ready for installation. In addition, any shortage of connectors or other parts will be immediately apparent.

In step 2, flexible leads have been connected to cell 7 of the new battery from the same terminal as those connected to cell 1 of the old battery. Connectors to be removed are indicated by dotted lines. Flexible connectors have also been installed between cell 12 of the new battery and cell 7 of the old battery. This allows removal of the connectors between terminal and cell 1 and also the connectors between cells 6 and 7 of the old battery without breaking the circuit. The circuit now becomes cells 7, 8, 9, 10, 11 and 12 in the new battery, and cells 7, 8, 9, 10, 11 and 12 in the old battery. Cells 1 to 6 in the old battery can be removed and replaced with cells 1 to 6 of the new battery.

Cells 1 to 6 of the old battery are placed on the floor and connected in series so that they can be used to maintain a full circuit in step 4.

Step 4 is similar to step 2. However, in this case, when cells 7 to 12 in the old battery are removed from the circuit, they are placed in the packing case in which the new battery arrived and removed from the battery room. This is indicated in step 5.

In step 6 the final connections are made and the old batteries completely removed from the circuit.

Milwaukee TRI-SPEED Kit for Electricians...

1 S-412 1/2" HOLE-SHOOTER, ball and roller-bearing equipped... Jacob's geared Chuck... 450 R.P.M.

2 "Two-Speed "Right-Angle-Drive" attachment... low side, 300 R.P.M. ... high side, 675 R.P.M.

3 3 special bits for boring in wood—3/4", 1 1/4" and 2 1/4".

4 Special wrench for attaching and adjusting "Right-Angle-Drive" and Chuck.

\$79.70

Adjustable "Long Arm" Accessory...
\$24.50 EXTRA *Pat. Pending



Milwaukee
QUALITY TOOLS

UNITED STATES RUBBER COMPANY

BEYOND COMPETITION

Developers and manufacturers of
better electrical wires and cables for every need

LAYTEX RU—the world's smallest diameter, lightest weight natural rubber covered building wire.

NEOLAY RU—with Laytex insulation plus Neoprene. Nylon cover makes pulling 5 times easier.

LAYTEX RUW—the building wire with the insulation resistance that increases in wet locations.

CONTROL WIRES—Insulated with Laytex RU for greater circuit integrity.

NEOPRENE COVERED SERVICE ENTRANCE CABLE—Flame-retardant, moisture resistant—the first ever accepted by Underwriters' Laboratories, Inc.

MUNICIPAL SIGNAL CABLES—Insulated with Laytex RUW for maximum moisture-resistance.

AUTOMOTIVE CABLE SETS

BATTERY SEPARATORS

USEX NON-METALLIC—Finest non-metallic sheathed cable ever made, incorporating the extra protection of Laytex insulation.

POWER CABLES—of every description, including Neolay Aircraft Wire.

ALUMINUM WIRES AND CABLES—U. S. Rubber introduced insulated aluminum conductors.

UNDERGROUND CABLES—The famous Grizzly line of tough cables.

ELECTRIX PLUGS—U. S. Rubber was a pioneer in the development of soft rubber plugs for cord sets.

ROYAL MASTER PORTABLE CORDS and many other types of electrical wires and cables.

ROYAL MINING MACHINE AND LOCOMOTIVE CABLES—Tested seven different ways to insure complete dependability.

USKON—ELECTRICAL RADIANT HEAT FROM THE CEILING

UNITED STATES RUBBER COMPANY • ELECTRICAL WIRE & CABLE DEPARTMENT

1230 Avenue of the Americas • Rockefeller Center, New York 20, N. Y.

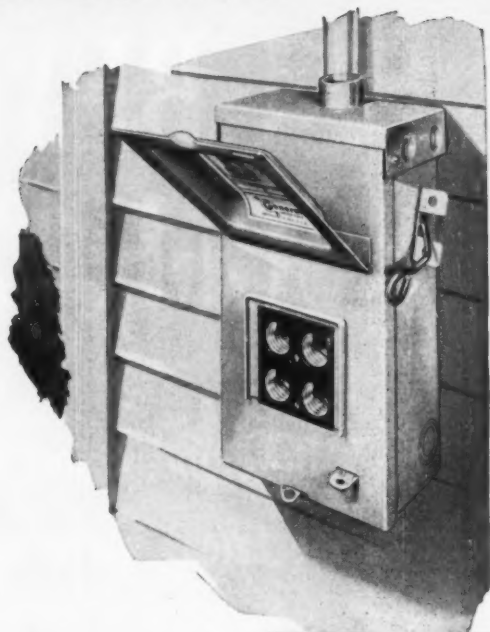
The Switch is to General for Outdoor Service

Single and Double
Pullout
Combinations

Front Operated
Toggle
Combinations


100 Amp
Fusible Main
Service Equipment

30 to 1200 Amp,
HP rated
Safety Switches



R33NP4
Side Operated
Plug Fused
Service Equipment

General makes a complete line of Weatherproof and Raintight Service Equipment and Safety Switches


THE next time take a good look at  General's outdoor equipment—recognized as one of the most complete lines of service entrance equipment and safety switches.

Enclosures made of *Zincgrip* steel are finished with a machine gray baked enamel for thorough protection against weathering—Dependable hinge design

safeguards interiors from rain, sleet or snow—Ample knuckle room and abundant knockouts are provided for convenient wiring.

These and many more distinctive features will be apparent to you immediately upon examination—sold everywhere exclusively through wholesalers.

Write for our latest catalog 4809—and supplement 4911

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Switch Corp.
49 Roebling Street Brooklyn 11, N. Y.

One of the largest Manufacturers of:
SERVICE ENTRANCE EQUIPMENT . . .
Pullout, Front Operated Toggle and Side Operated types.
Indoor—surface or flush, and Outdoor.
ENCLOSED SAFETY SWITCHES . . .
30 through 1200 Amp., 250 V and 600 V Type A, C and D.
Indoor and outdoor, HP rated.
BRANCH—CIRCUIT PANELS
SALES OFFICES IN EVERY MAJOR CITY

In the News

North Central Groups Hold All-Industry Meeting

Despite a quickie blizzard, more than 450 electrical contractors from Minnesota and adjoining states helped swell the registration to more than 1,200 at the annual electrical industry convention held at the St. Paul Hotel, St. Paul, Minn., on Mar. 5-9. Sponsored by 16 trade associations and co-ordinated through the North Central Electrical Industries, Inc., the five-day conference agenda included individual group sessions with prominent industry speakers. A trade exposition featuring 97 booths (everything from appliances to distribution equipment) drew a selected audience of some 5,000 people. Admission was by card only.

For the first time in the history of the conference, a labor seminar on employer-employee relations was held Sunday afternoon. The closed session, sponsored by the Midwest Electrical Council (contractor coordinating group), featured such speakers as Richard S. Felhaber, St. Paul labor relations attorney; Donald M. Wakefield, attorney for Midwest Electrical Council; and Orlin Folwick, director of public relations, Minnesota State Federation of Labor.

At the opening all-industry luncheon, W. V. Merrihue, manager, industrial relations, General Electric Company, related the impact of union and government developments on employee relations; believes too few businessmen

can detect when they have been pushed into the political field. Mr. Merrihue listed failure to correct economic misconceptions as the "missing link" in employee relations; revealed that G. E. is producing a "packaged" discussion economics course for its own plants and offering it to others.

The 22nd annual meeting of the Minnesota Electrical Association, Inc. (contractors outside Twin-Cities area) drew a record attendance to hear association reports and discussions of electric heating and estimating practices. With the electrical contracting industry definitely in a buyer's market, retiring president John Engel of Rochester, Minn., fears the upward trend in wage rates is pricing the contractor out of the installation market. Engel scored the vindictive bidding practice of some contractors; warned against estimating "the competitor's bid price" rather than the actual job.

Reviewing the future of the electrical heating market, W. T. Stuart, editor, *Electrical Construction and Maintenance*, predicted that within 10 years electrical space heating will be handling five to ten percent of the total heating load in the country. Stuart based his forecast on the past history of electrical industry super salesmanship; cited the example of the rapidly expanding electric clothes dryer market competing with free air and a length of clothes line; noted the

accelerated demands for electric space heating in the South. He does not believe electric heating will have to slug it out dollar vs. dollar with conventional systems; is confident the electrical industry will solve any problems arising; sees the possibility of industrial and commercial electric heating installations.

Ralph H. Decker, consulting electrical engineer of Chicago, suggested that contractors pocket their petty jealousies and share their experiences and ideas for the good of the industry. While reviewing the fundamentals of good bidding and estimating practice, Decker warned those present against taking jobs for their "advertising value" or to "keep the men busy;" suggested that contractors let their organization, ability and financial responsibility be the measure as to number, character and size of jobs bid. Never let a good estimator go, regardless of salary considerations, he added noting that estimators are *made* not born. Mr. Decker then outlined his method of making detailed, accurate estimates of all projects his firm engineers.

The Midwest Electrical Council, Inc. (coordinating association for all contractor groups) now has a membership of 700, an increase of 100 during the past year, secretary Wm. A. Ritt reported at the 18th annual meeting of that group. Newest affiliates of the



CAREFULLY CHECKING PLANS before starting an electrical project are: (L to R) Jerry Whitlow, estimator; Jim McClure, president; and George Britt, purchasing agent, of McClure Electric Co., Dallas, Texas electrical contracting firm.



LOBBY SESSION finds St. Louis electrical contractors talking shop. (L to R) Paul Wendt; Ray Great-house; Hascal Schneider; and George Prader of Bradford Armature Works in East St. Louis, Illinois.



T. W. EHLERT, chief of electrical construction, Heil Company, Milwaukee, checks gage light applications with **P. S. Linscott** (right) manager of Crouse-Hinds Co. Milwaukee branch.



Quicker than lightning, the self-contained RAMSET TOOL instantly sets drive pins or threaded studs through steel or wood, into steel, concrete, masonry, other hard materials. Slashes costs and time up to 80% for such fastening jobs. Takes less than a minute from start to finish—faster than you can load and light your pipe! Here's why:

1. No drilling, chipping, plugging, tapping.
2. Insert RAMSET FASTENER into tool, with power charge.
3. Place against work spot. Then RAM! The fastener sets, instantly, tightly.
4. No make-ready or clean-up work. No muss, no fuss, no dirt.
5. Light, compact RAMSET TOOL needs no external power. It's completely self-contained.
6. No hauling heavy equipment. RAMSET TOOL can be carried in one hand and used in tight, confined spaces.
7. Small first cost, pays for itself quickly—and it's savings and profit from then on!

Every day, thousands of users prove the value of RAMSET SYSTEM... the pioneer in powder-actuated fastening methods. A 15-minute demonstration will prove its cost-reducing, time-saving values. Call your local RAMSET Specialist or use coupon for complete details.

STEMCO CORPORATION
12117 Berea Road • Cleveland 11, Ohio

ASK FOR DEMONSTRATION AND DETAILS!

Stemco Corporation, 12117 Berea Road, Cleveland 11, Ohio

Please send further information on cost-cutting, time-saving value of RAMSET FASTENING SYSTEM.

Name _____ Title _____
Company _____
Kind of business _____
Address _____

Council are the Electrical Contractors Society of Washington and the Iowa Electrical Association. Ritt reiterated that the Council does not organize, replace, nor interfere with local group activities; offers service and guidance to affiliates. He warned that contractors must show they can get along with each other before they can command respect of the public; added that selfish interest and indifference to the common welfare are the basis of organization failures. Biggest problem ahead involves reinspection and re-wiring programs, he concluded.

Rural Electrification

At the business session, the Council adopted a resolution calling for removal of federal excise taxes on lamps and appliances and protesting the proposed 10 percent tax on television receivers.

Dean C. H. Bailey, University of Minnesota Department of Agriculture, presented the Four Freedoms on the Farm to the Rural Electrical Equipment Section meeting. They are: Freedom to work, mechanize, increase operating efficiency, and live comfortably. That these are being realized on Minnesota farms was convincingly revealed by A. J. Schwantes, chief of the University of Minnesota division of agricultural engineering. Last year, 27 percent of Minnesota's population lived on farms (U. S., 15 to 18 percent) with an average acreage of 182 (12 percent larger than 1935). In 1920, 10 percent of Minnesota's farms had electricity. Last year 75 percent were electrified and 30 percent had running water; one-third, central heating; one-third, hot water; and 14 percent, home freezers, Schwantes stated.

One interesting comparison was made on a single distribution line in a southern Minnesota dairy farm area. Average kw/hr. per month consumption (1,313 farms) in 1939 was 62 at a 7.4-cent rate; in 1949 the average consumption was 300 kw/hr. per month (4,234 farms) at a 3.2-cent rate. Nationally, the horsepower per agricultural worker in the United States was 4.5 in 1920. In 1948, the figure had climbed to 33.5 horsepower, Schwantes stated.

We must get correct information to the farmer, stated Frank E. Watts, executive assistant, *The Farm Journal*. Study the farmer's operation, survey his needs, then design the electrical system accordingly, he urged. A farmer can make a dollar for each dollar he spends on his electrical system. Watts added noting that with the right approach to the farmer on electrical adequacy, the farmer may even go further than the contractor suggests.

INDUSTRY'S STANDARD

IDEAL

for over 26 years!



The Solderless, Tapeless Wire Connectors
Patented, No. 1,933,555

**SCREW ON
—like a nut
on a bolt!**



**faster—safer
wire joints —
without TOOLS,
Solder or Tape!**

APPROVED FOR ALL TYPES OF BRANCH CIRCUIT WIRING

Why bother with special tools, solder or tape, when you can make strong, safe wire joints easier and faster with IDEAL "Wire-Nuts"? Actual surveys show that more contractors prefer IDEAL "Wire-Nuts" than any other method of making wire joints. This is why: . . . "Wire-Nuts" are faster—just screw them on—like a nut on a bolt. "Wire-Nuts" are safer—sharp wire ends are covered and fully insulated. "Wire-Nuts" are stronger—have precision-built spring inserts that are checked and tested to .001" tolerances. "Wire-Nuts" are more dependable—shake-proof, permanent. Average cost is only one cent per joint! Use them for all types of branch circuit wiring — conduit — armored cable — non-metallic sheathed cable and open wiring. Make sure you get genuine IDEAL "Wire-Nuts". Two contractor sizes—Nos. 74B and 76B—listed by Underwriters' Laboratories, Inc. as "Pressure Cable Connectors"—suitable for all types of branch circuit wiring.

SOLD THROUGH AMERICA'S
LEADING DISTRIBUTORS



IDEAL INDUSTRIES, Inc.
SYCAMORE, ILLINOIS

these
IDEAL wiring
tools save you
time and money!



Coil-Flex Fish Tape
(PAT. PENDING)

Speeds wire pulling in all kinds of conduit. Steel spring, wound around stranded cable slips easily around 90° bends. Never kinks, snags or springs loose. 25-ft. lengths quickly join into longer tape.

**EASIER, SAFER
ELECTRICAL TESTING**



IDEAL Voltage Tester

Gives **DOUBLE PROTECTION**—a solenoid indicator and neon test lamp. Not an ordinary "glow" type. Actually indicates nominal line voltage on easy to read scale. 110 to 550V AC; 110 to 600V DC. Tests AC or DC, grounds, fuses, etc. Carrying case.

**BOLT JOISTS
5 TIMES FASTER**



JOIST BORER

No stoop, strain or backbreaking effort. Does job where no other tools can be used. Comes knocked down, less pipe, for quick assembly on job. Adjustable (with pipe) for heights up to 12 feet.

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1041 Park Ave., Sycamore, Ill.

- ☐ SEND FREE SAMPLE IDEAL "WIRE-NUTS"
☐ SEND CATALOG DATA ON WIRING TOOLS

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

NEW LOW PRICE!
24" BELT DRIVE
EXHAUST FAN
Catalogue No. BD 245

your cost only **\$25**
(former net price \$29.50)

3500 cubic feet of fresh air per minute

QUIET! Ideal for attics, barns, stores, factories!

Genuine Quiet bearings

Genuine Torrington fan blade

Smooth tubular supports

Rubber mounted

Stainless steel for easy mounting

List Price **\$49.50**
STANDARD ELECTRIC
"The Big Name in Fans"

STANDARD ELECTRIC
MANUFACTURING CO.
WEST BERLIN, N. J.

1/4 HP - 110 volt - 60 cycle AC - GENERAL ELECTRIC

WRITE FOR CATALOG 4E

Wiring Codes Session

The Wiring Codes meeting sponsored by the Minnesota State Board of Electricity and the Minnesota Electrical Inspectors Association drew a capacity audience on the final day of the convention. Harry Edmunds, president, Minnesota State Board of Electricity and a farmer and electric co-op leader for over 50 years, revealed that more than \$2 million fire loss in Minnesota last year was traced to faulty wiring; made a strong plea for good initial electrical inspection and an effective re-inspection program in rural areas.

Glenn Rowell, electrical engineer, Fire Underwriters Inspection Bureau, Minneapolis, reviewed the new recommendations for electrical installations in hospital operating rooms; revealed that a nation-wide survey of hospital conditions indicates that practically every hospital will have to make changes—many of them electrical in nature.

The remainder of the session was devoted to a discussion of Code rules and interpretations with specific emphasis on rural installation problems.

All-Industry Sessions

Spaced throughout the conference were all-industry sessions covering such subjects as lighting, merchandising, promotion and research. At the lighting session, the Indianapolis NEMA survey was reviewed to show the market commensurate with lighting presents in the typical American city. Reviews of five lighting campaigns prepared by North Central Electrical Industry committees were presented by a panel of local lighting industry talent.

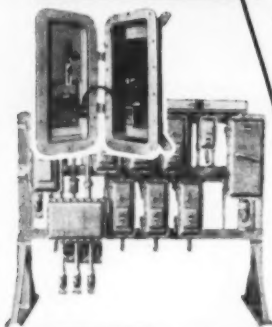
At the dealer merchandising session, G. M. Kendrick, branch sales manager, American Blower Corp., told about the new business opportunities electric ventilation offers the appliance dealers and contractor-dealers. Joe Marty, manager, radio and television department, The Admiral Corporation, Chicago, told the audience that TV color is three to five years away; will be an added service and not replace or make obsolete black and white receivers. Marty declared that 4½ million TV sets were functioning as of January 1st; that another four million would be produced this year; that from 18 to 20 million sets would be in use in five years.

We must be more rural sales-minded, Frank E. Watts told the all-industry on promotion. The job of electrifying farms that now have service has scarcely begun, he declared. Taking eleven basic appliance products, plus wiring, Watts sees a conservative potential market of \$2.5 million per day for 300 days per year for

R&S

CBS STARTERS CIRCUIT BREAKERS

Complete Line
**EXPLOSION-PROOF
DUST-TIGHT**
Class 1, Group D



Meet ALL Standards PLUS

NON-FREEZING revolving shaft for operating Push Button Station and Manual Reset.

SLIDE OPERATING MECHANISM . . . no strain on circuit breaker handle.

PRECISION HINGED REMOVABLE COVER permitting complete accessibility to equipment for installation, maintenance and close grouping.

STAINLESS STEEL cover bolts . . . High strength enclosure . . . aluminum gray, corrosion resistant baked enamel finish.

ABUNDANT WIRING SPACE with conduit outlets on top, sides and bottom . . . factory plugged to exclude dust, dirt, and moisture.

INDIVIDUAL UNITS and factory assembled panels of two or more units as illustrated . . . NEMA sizes 0 to 4. Also waterproof types.

DEPENDABLE OPERATION insured by 48 years of design and manufacturing experience.

813 Write for Catalog H47-4



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| How to get started | Personnel and their remuneration | Disposal of inoperative lamps |
| What your maintenance customer wants | Operating schedules | Replacement starters |
| How to sell your service | Emergency calls | Inspections |
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| | Group replacement of lamps | Estimating costs |
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ONE of your most promising new sources of profits these days is lighting maintenance! And General Electric has a new free booklet to help you cash in! Lighting Maintenance is a rapidly growing field because most prospects aren't prepared to maintain today's modern lighting equipment. Many are learning that dirty lamps and fixtures rob them of light they're paying for. They'll welcome a good maintenance service. And every store, office and factory is a prospect.

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A lighting maintenance service is a money-making addition to your other electrical work. It brings in a steady income, and can grow into big business. In addition, regular service calls make you the firm customers think of first for other electrical work.

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To help you get a good start in this fast-growing business, G-E lighting men have written a complete lighting maintenance manual. Its 20 pages are packed with helpful information on how to set up cleaning schedules, make repairs, estimate costs and handle many other important details. If you want all the profits that lighting maintenance can bring you, this booklet is a must. Send in the coupon today and get your free copy while the supply lasts.



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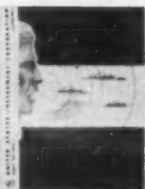
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SUMMIT...NEW JERSEY



WILLIAM KENNEDY, standing, is the new president of the San Francisco Electrical Contractors Assn., succeeding **W. B. Baker**, seated left, **Edward Scott**, secretary and **William J. Varley**, manager of the association are at right.

the next 12 years for home equipment alone. Add another \$1.5 million per day for productive equipment, he stated, and you have a pretty good picture of the market.

Frances Armin, director of consumer education, National Adequate Wiring Bureau, outlined the program to sell America Certified Adequate Wiring; Gordon Volkenant demonstrated the wonders of electronics in a glamorous stage presentation.

During another spectacular stage presentation, Dr. Richard C. Hitchcock, Westinghouse Electric Corp., reviewed the march of research in the electrical industry.

Governor Luther W. Youngdahl was the principal speaker at the all-industry banquet.

The following officers were elected. **Minnesota Electrical Association**—President—C. D. Burton, Brainerd, Minn.; vice-president—L. A. McClure, Luverne, Minn.; secretary-treasurer—Wm. A. Ritt, St. Peter, Minn.; manager—A. Earl Anderson, Minneapolis. New directors elected included John Engel, Rochester; Norman DeYoung, Fairmont; and Elroy Lehn, Anoka, Minnesota. Elected to represent the association as Directors to the Midwest Electrical Council, Inc., were: Sam Newstone, Montevideo; John Ellenbecker, St. Cloud; Eric G. Nyland, Duluth; Ed N. Karst, Fergus Falls; and Wm. A. Ritt, St. Peter.

Midwest Electrical Council—President—Clyde Kieley, Grafton, North Dakota; vice-president—John H. Engel, Rochester, Minn.; treasurer—F. M. Tripp, Minneapolis, Minn.; secretary—Wm. A. Ritt, St. Peter, Minn.; manager—Gordon Tucker.

Minnesota Electrical Inspectors Association—President—Wm. A. Patenau, Elk River, Minn.; secretary-treasurer—Glenn Rowell, Minneapolis.



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Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment. Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push. Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.

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Here's a ceiling lighting system that really pays off in efficiency and economy . . . helps build your reputation, too.

In this modern lighting system, Sylvania Fluorescent fixtures are mounted on the original ceiling. 32-inch square louvered, "eggcrate" aluminum grids are then suspended below the fixtures. The result is an attractive illuminated ceiling . . . a soft natural sky-light effect . . . ideal for the most advanced general office lighting.

SAVES MONEY

And, you'll be amazed the way this modern system cuts your job costs. For example, there's no need for the expense of burying your wiring in concrete. Entire area between the ceiling and the "Flexi-Module" panels is open, less expensive wiring may be used—result, lower labor costs. Your men get on and off the job faster.

Furthermore, the installation of "Flexi-Module" is surprisingly simple . . . saves time and labor. Detailed illustrations at right show you why.

ENDLESS COMBINATIONS

"Flexi-Module" permits the highest flexibility of lighting arrangements. Variations are easily obtained in both quality and quantity of light by selecting different colored units and various types and colors of Sylvania Fluorescent lamps.

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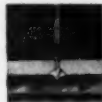
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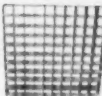
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Non-static aluminum grids need no dusting or painting. Sections 32" x 32" are lightweight, attractive, easy to handle . . . easy to install.

New, illustrated folder brings you full details about "Flexi-Module" as well as other popular Sylvania office fixtures. Mail the coupon for your copy today!



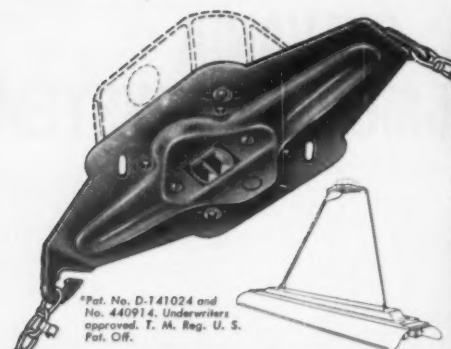
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IN LESS TIME...AT LESS COST...WITH LESS WORK

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HYDEE HANGER*

"DECIDEDLY BETTER"

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Lighting Fixtures

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1. Connect wires to receptacle.
Fits standard 4" or 3 1/4" outlet
box or plaster ring.



2. Screw hanger to outlet box—
only two screws needed. No
centering, punching, or drilling.
Screwdriver only tool needed.



3. Hang the fixture and plug it
in. That's all! Self-grounding—
regular 2-wire cord and plug
may be used.

Hydee Hanger: com-
plete with receptacle, two
5-ft. chains, "S" hooks
and clips—list price,
each \$1.65.



NEW CHAIRMAN of the Illinois
Chapter, International Association
of Electrical Inspectors, **W. M. Schoknicht** (left) of Rockford, Ill.,
receives congratulations of retiring
chairman **Anton Pertle** of Chicago,
at recent annual meeting.

NECA to Meet in Los Angeles in October

The date for the 1950 Annual Convention of NECA has been set for October 17-20, inclusive, and it will be held at the Biltmore Hotel, Los Angeles. Theme of the Convention will be "Progress through Efficient Management and Training."

The announcement was made by President Edw. Vanderlinde of NECA following the regular mid-winter meeting of the NECA Administrative Committee at Miami, Fla.

The theme for the Convention reflects the major activities of NECA this year. The Association's objectives are aimed at promoting progress for the \$1,500,000,000 a year Electrical Contracting Industry.

Among the activities designed to promote industry progress is the industry-wide technical and management personnel training program initiated by NECA at its Convention at Houston last year. A course of instruction in the fundamentals of the business of electrical contracting is being prepared in the form of a curriculum and in textbooks for the use of members desiring to improve the qualifications of their management and technical personnel.

"This progressive step by NECA is undertaken to keep pace with the rapid expansion of electrical use and the growing demand for many and new types of electrical applications," President Vanderlinde said. "The safe, efficient and economical use of electricity by the public depends to a dominant degree upon the competence of the application engineering provided. That is the field of the electrical contractor

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Now for the first time in over 70 years comes a basic, revolutionary improvement over sticky, old-fashioned friction tape. It's **POLYKEN** No. 163 Electrical Tape... available now through your electrical distributor in three convenient packs. And dependable **POLYKEN** No. 163 costs *no more* than most ASTM friction tapes. See your distributor or write today for free folder "Test It Yourself." Address **POLYKEN**, Dept. 14-4, 222 W. Adams St., Chicago 6.

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A MACHINE IN HIS PLANT



**...yet he hasn't
had a Chest
X-Ray!**

He checks every piece of mechanical equipment he owns for wear, lubrication, efficiency.

Yet he fails to take the simple precaution of a Chest X-Ray to make sure he does not have tuberculosis. *Not because he's opposed to the X-Ray. Simply because he is not sufficiently informed—or just hasn't taken the time and trouble, or does not realize the seriousness of the problem.*

A Chest X-Ray is the first step toward detecting tuberculosis in its early stages. And in its early stages it can be cured with the least loss of time from work.

So, if you're the man above, that one simple reason should make you get your Chest X-Ray—*today*. But listen, see how serious this really is:

Between the ages of 15 and 34, tuberculosis leads all other diseases as a cause of death—although at no age are you safe from TB. Yet, if everyone does his part by getting a Chest X-Ray periodically, and the majority of cases thus discovered are followed up, we can eliminate TB entirely as a public health hazard!

Will you do your part today? Get a Chest X-Ray. It may mean your life!



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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1950

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SOLDERING HEATING BRAZING

Prest-O-Lite 5-in-1 Precision-Control Outfit

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Four stems and soldering copper cover every electrical job, from heavy soldering or heating to wire splicing or finest work on delicate instruments... Burns "Prest-O-Lite" Acetylene, from handy, small tanks, at automatically regulated, constant pressure... Needle valve flame adjustment... Full heat (2,800 deg. F.) instantly, without pumping, priming, or warmup... No smoke or fumes... Light and easy to handle.



Precision Model \$22.50
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Designed for your need —
the new

TAL E.M.T. Bender

pays for itself
in the time
that it saves.



Also attachable to Tal 2" or 3" Pipe or Conduit Benders.

Think what you can do with this new portable machine that bends all types of thin-walled tubing on the spot:

- free from kinks
- free from wrinkles
- no shifting of tubing
- easy to operate
- less than one minute required to make any bend in one single setting

Anyone can handle this machine — even inexperienced labor — and do in seconds work that requires minutes with other equipment. It comes packed in a handy tool box — and because the frame, formers and bars are made of a lightweight alloy, one man can carry it easily.

Write today for full information.

TAL Bender, Inc. Dept. 21 Milwaukee 2, Wis.

and our Association deems it an obligation to the public and an essential to its progress to help make a sufficient number of electrical contractors thoroughly qualified to fill this demand. Electricity is too valuable to permit its misuse and incompetent application."

The personnel training program is being developed by the NECA Management and Technical Personnel Training Committee. Its chairman is Robt. W. McChesney, immediate past president of NECA. Every section of the United States is represented in the committee membership. Its immediate task is the preparation and publication of study units on subjects peculiar to the business and which never have been reduced to a formal study pattern. This work is scheduled to be well underway by the time of the Convention at which time the pioneering program will be analyzed and evaluated.

Hand in hand with this management and technical personnel training program is the NECA program for developing skill within the industry through apprenticeship and training of electrical workers. This is going forward this year on an expanded basis under joint labor and management direction. The Association formally recognizes the significance of skill by an annual award of the NECA Gold Apprenticeship Medal to the outstanding apprentice selected through nationwide competition. The presentation of this award will be one of the features of the Annual Convention at Los Angeles.

Quad City Contractors Elect Officers

The Quad City Electrical Contractors Association—Quad Cities Chapter, NECA has elected the following officers to serve for the ensuing year:

President, G. O. Farlow, Farlow Electric Co., East Moline, Ill.; Vice president, Louis L. Corry, Corry Electric, Davenport, Iowa; Secretary-Treasurer, H. P. Wilson, Rock Island, Ill.; and Member NECA Board of Governors, Wm. J. McNealy, Electric Construction Co., Rock Island, Ill.

NISA Chapter Notes

Activities of the National Industrial Service Association chapters continue at an accelerated pitch. Interest in shop problems, operating techniques and general business administration is mounting. Monthly chapter meetings act as a clearing house for data and information pertinent to shop operation in the respective areas.



TAKING ADVANTAGE of Milwaukee Electrical Maintenance Engineers Exposition, Louis Luebke (right), city electrician, Appleton, Wis., gets latest data on circuit breakers from C. L. Seahorn, field engineer for Bull Dog Electric Products Company.

An unusual departure from the "shop-talk" type of program was made at the recent two day meeting of Region 7 held at Cincinnati's Hotel Gibson. Presented at the conference were such subjects as: Rebirth of Selling; Social Security and Pensions; Taxation Trends; Management's Leadership Responsibility; The Hoover Report; The Challenge to our American Way of Life and Facing the Future. Among the prominent local business executives addressing the 83 registrants on this series of related topics were: Lynn H. Hummel, sales manager, Glow Electric Co.; Howard Campbell, president, Gardner Publications, Inc.; H. Lyman Greer, vice-president, Fifth Third Union Trust Co.; Fred Giesel, Cincinnati Post; Douglas K. Fuller, executive vice-president, Cincinnati Chamber of Commerce; Wm. L. McGrath, president, Williamson Heater Co.; Fred Smith, vice-president, William Powell Co.; and the Honorable James G. Stewart, Judge of the Ohio Supreme Court.

The Southwestern Chapter held a two-day conference at Shreveport, La., at which time the following officers were elected: President—John M. Young, Anderson-Young Electric Co., Lubbock, Texas; first vice-president—J. B. Johnson, J & J Armature Works, Tyler, Texas; second vice-president—Carl Pons, Carl Pons Electric Co., Shreveport, La.; treasurer—Gus R. Lieber, Shreveport Armature & Electric Co., Shreveport. Virgil Goodman of Fort Worth, Texas, was re-appointed secretary.

The Northern California Chapter held election of officers at its regular quarterly meeting in February. Chosen to guide the Chapter activities for the

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**TO HANDLE ANY MATERIAL
DISPENSED FROM A REEL**
quickly, easily and safely!



AUSTIN
No. 600
REEL
ROLLER



MAXIMUM
CAPACITY: 4000 LBS.
WEIGHT: 75 LBS. EACH



OUTSTANDING ADVANTAGES:

- 1 Ramp makes loading fast and easy
- 2 Five adjustable slots take various reel diameters
- 3 Thumb screw locks front roller for reel removal
- 4 Single unit takes reels up to 30" wide
- 5 Bolt two units together for reels up to 64" wide
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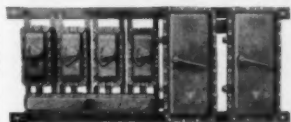
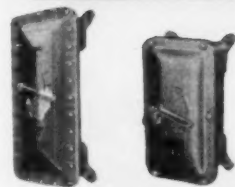
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ENCLOSED CIRCUIT BREAKERS

Complete Line
**EXPLOSION-PROOF
DUST-TIGHT**
Class I, Group D



Meet **ALL** Standards **PLUS**

SLIDE OPERATING MECHANISM . . . no strain on circuit breaker handle.

PRECISION HINGED REMOVABLE COVER providing complete access to equipment for installation . . . maintenance and close grouping.

STAINLESS STEEL cover bolts . . . high strength enclosure . . . aluminum gray, corrosion resistant baked enamel finish.

ABUNDANT WIRING SPACE with conduit outlets on top, sides and bottom . . . factory plugged to exclude dust, dirt, and moisture.

INDIVIDUAL UNITS and factory assembled panels of two or more units as illustrated . . . 10 to 600 amperes and up to 600 volts AC . . . Also waterproof types.

DEPENDABLE OPERATION insured by 48 years of design and manufacturing experience.

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Buy Standard and have your transformers tailored exactly to your needs, with accessories of your own choosing. Our complete consulting and engineering facilities are at your service.

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OFFICES IN PRINCIPAL CITIES



TEXAS CONTRACTORS in a huddle include (L to R) Paul Martin and W. B. Cline of Corpus Christi; and F. E. Murray, Jr., and Jack Hill of Houston.

coming year were: Chairman—M. J. Buzzell, Buzzell Electric Works, San Francisco; vice-chairman—George R. Duncan, Smith, Lindstrom and Duncan, San Francisco; secretary-treasurer—Henry Hewelcke, North Bay Electric Works, San Rafael.

NAWB Studies St. Louis Operation

Strong indications of a revitalization of the Adequate Wiring program, a promotional effort to bring electrical adequacy to the nation's homes, were evident at the recent Sixth Annual National Adequate Wiring Conference in St. Louis' Hotel Statler. More than 150 conferees journeyed to St. Louis from all sections of the country to absorb more adequate wiring "know-how" and to study, at first hand, the highly successful operation of the St. Louis Adequate Wiring Bureau.

Conference chairman A. H. Kessler, president, International Association of Electrical Leagues, keynoted the program with his theme "1950 is The Time." Commenting on the growth of electrical utilization in the American home, Kessler noted that last year the following appliances were added to existing electrical systems; 1,056,000 electric ranges; 695,000 electric water heaters; 4,450,000 refrigerators; 3,200,000 units of home laundry equipment; 2,600,000 television sets. Also sold were 3,000,000 vacuum cleaners; 2,450,000 coffee makers; 4,200,000 toasters and 6,310,000 electric irons. All represent millions of kilowatts added to already overburdened electric systems. With utilities "bringing in" additional generating capacity, the problem is now one of insuring adequate electrical systems



Surface Wiring

The UNION surface wiring line is designed to supplement not duplicate existing stocks.

Installed by standard wiring methods.

Eliminates the cramped and exacting wiring problems found in many surface devices.

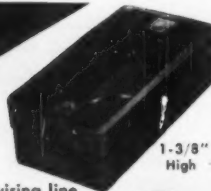
Ideal for farm buildings, garages, attics, basements, etc. Listed by Underwriters, Inc. Approved by REA.

At Its Best

UNION INSULATING CO.

PARKERSBURG, WEST VIRGINIA

No. 5020
Brown



1-3/8" High



5071-1



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5051

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in the home for efficient appliance operation.

Singled out for a session analysis was the St. Louis Adequate Wiring Program, one of the broadest and most successful certification operations in the country. It has won public approval and the enthusiastic backing of the local builders, wholesalers, manufacturers, contractors and utility.

Prior to 1939 there was no adequate wiring promotion in the St. Louis area and residential wiring standards were "disgracefully low," according to Carl Christine, secretary-manager, St. Louis Electrical Board of Trade. Starting from scratch in the middle of the year, the local AW Bureau certified six homes in 1939; 89 and 83 the following two years and 17 for four months operation in 1942. After the war, ten months operation in 1946 saw nine homes with the label. In 1948, 130 homes were certified; last year 627 with a substantial number in the \$9,000 speculative builder type house.

Since 75 to 80 percent of home construction in St. Louis is by speculative builders, AW promotional effort was directed mainly to this segment. Evidence of success is that the Schuermann Building and Realty Company, one of the mid-west's largest merchant builders, now has a 450-home development and a proposed 600 home project in St. Louis with adequate wiring and all-electric kitchens. As J. M. Bogdanor, vice-president of the building firm stated, "home buyers want the electrical conveniences that AW makes possible. He added that certified wiring cost only an additional five dollars per home in his development of homes ranging from \$8,650 to \$9,000.



CHECKING FABRICATED end shield for shaft extension on a 200 hp, 900 rpm, 230-volt, dc traction motor are Roy A. Berents (left), president; and L. B. Davenport, shop superintendent of Roy A. Berents Company, Houston, Texas, motor repair and rebuilding.

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

The "EFFICIENCY" CABLE STRAIN CLAMP

—withstands direct pull of 17,000 lbs.

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Note These Features:

- Withstands direct pull of 17,000 lbs.
- Takes cable from 1/0 to 1,500,000 c.m.
- 3 clamp sizes cover all cable sizes.
- Furnished with eye or clevis
- For AC or DC service

- Without possible strain or damage, Efficiency Cable Strain Clamps are slipped over cable and tightened with U-bolts—locking cable safely and securely. H construction of clamp and high ridge across center of cable channel prevent cable from slipping. Write today.

Efficiency
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ADJUSTS
WITH A
TWIST OF THE WRIST

"Friction Set"
Fixture Hangers
FOR INSTANT ALIGNMENT

At last you can get a Fixture Hanger that turns to any angle after being screwed to an outlet box. Although base and receptacle remain stationary, hanger arms may be turned to align with any preconceived lighting plan. Exclusive Friction Ring firmly holds fixture in selected position. Hanger screws on to 3/4" or 4" outlet boxes, no other fastening necessary. Furnished complete with receptacle, two 5' chains, hooks and cord clips. Also available with bushed hole only, or with 3 wire solid ground receptacle. All Friction-Set Hangers are approved by the Underwriters' Laboratories. K100 shown above, List Price \$1.10 • Write for Bulletins K25, K26 and K27

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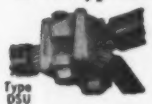
DOSSERT CONNECTORS



DOSSON

Service Connectors
For quick efficient
connections of solid
and stranded conductors
in sizes No. 14 to
1000 MCM.

Bolt Type Service Connectors



DOSULON—for
conductor sizes from 2/0
to 1000 MCM. Rugged,
high strength, compact,
facilitates neat
rapping.

DOS-LUG

Solderless Terminal Lugs



A compact, inexpensive,
all-purpose lug
for high performance.

"Insist on a Genuine DOSSERT"
Write for Bulletin T49-2

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SINCE 1904

TAPES by OKONITE

YOUR GUARANTEE
OF EXTRA VALUE



"The tape with the
yellow core"

Sold only through
Recognized Wholesalers

Ask for them by name
Panther and Dragon
friction and rubber tapes

For the first time at a National Adequate Wiring Conference, the old question of the electrical contractor's reputed indifference to Adequate Wiring was aired on the debating platform. Presenting the electrical contractor's views on the subject "Who's to Blame for Contractor Inertia?" was H. L. Scott, Corpus Christi, Texas, chairman, Business Development Committee, NECA. Upholding the utility viewpoint was F. E. Davis, member of the Executive Committee, NAWB, and chairman, Wiring Committee, EEI. Moderator was N. J. MacDonald, chairman of NAWB.

Other industry leaders presented their approaches to AW promotion. J. M. Mooney, wiring consultant, Louisiana Power and Light Company outlined his company's long-term program for selling adequate wiring; the effective use of check lists for customer appliance and lighting requirements before wiring layouts are made; and the extensive variety of promotional activities.

J. R. Poteat, manager, General Electric Co. range and water heater division, stressed the need of having the 80,000 to 100,000 retailers on the adequate wiring promotion team.

O. K. Coleman, engineering consultant, EEI, discussed the EEI-AEIC Report on Branch Circuit Over-Current Protection; explained the Committee proposal in relation to the extension of No. 12 wire branch circuits, protected at 20 amperes, to all rooms.

At the concluding open forum discussion, Frances Armin, director of consumer education, NAWB, described the new consumer pieces offered by the Bureau, a new folder to win greater contractor participation, trade paper advertising scheduled for construction magazines, trade advertising to home economists on adequate wiring teaching materials, and news releases to be offered this year.

Dates Ahead

American Society of Tool Engineers—Industrial exposition, Convention Hall and Commercial Museum, Philadelphia, Pa., April 10-14.

Chamber of Commerce—38th Annual meeting, Washington, D. C., May 1-4.

National Fire Protection Association—54th Annual Meeting, Haddon Hall, Atlantic City, N. J., May 15-18.

National Industrial Service Assn.—Annual meeting, Boston, Mass., June 5-7.

National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., June 12-16.

New York State Association of Electrical Contractors & Dealers, Inc.—Saranac Inn, Saranac Lake, N. Y., July 1-3.

International Municipal Signal Assn.—55th Annual convention, Hotel Commodore, New York, N. Y., Sept. 18-21.

Canadian Electrical Manufacturers Assn.—Annual meeting, General Brock Hotel, Niagara Falls, Ont., Sept. 27-29.

National Electrical Contractors Association—Annual convention, Hotel Biltmore, Los Angeles, Calif., Oct. 17-20.

National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., Nov. 13-16.



DISCUSSING LOCAL problems are Milwaukee electrical contractors Roman Rozmarynowski, Roman Electric Co.; and Lester J. Fieldhack.

Manufacturers News

GENERAL ELECTRIC APPOINTMENTS

J. E. Ryan and C. P. Hayes have been appointed staff assistants to B. A. Case, manager of engineering of General Electric's Small Apparatus Divisions.

James Hollands Alderman has been named district representative for the Construction Materials Department. He has been assigned to the department's North Central district with his home office at 110 North Illinois St., Indianapolis.

A new G.E. apparatus sales district has been established. C. F. Maughmer, formerly manager of the G.E. sales office at Los Angeles, has been appointed to head the new organization, which has its headquarters at St. Louis. The new district consists of all sales areas presently in the company's St. Louis, Kansas City and Omaha territories.

H. J. NEWTON RESIGNS FROM NATIONAL ELECTRIC

Harold J. Newton has resigned as vice president and general sales manager of National Electric Products Corp., Pittsburgh. His resignation was for reasons of health, after 38 years of service with National.

W. C. Robinson, Jr., vice president indicated that his office would supervise sales of the company's electrical roughing-in materials.

PENNSYLVANIA TRANSFORMER APPOINTMENTS

Announcement has been made of the appointment of M. L. Manning as development engineer of Pennsylvania Transformer Company, Canonsburg, Pa.

Boris Volgovskoy has been appointed as head of the Substation and Regulator Department.

J. B. Sullivan has been named sales engineer with the New York District sales office.

H. J. Schwarberg has been named sales representative in sections of Ohio and Kentucky. Mr. Schwarberg will work out of Cincinnati, Ohio.

T. O. MOLONEY ELECTED BOARD CHAIRMAN

Thomas O. Moloney was elected chairman of the Board of the Moloney Electric Company at the annual meeting of stockholders, to succeed the late Thomas O. Moloney, Sr.

George J. Kribs was elected Treasurer succeeding Mr. Moloney, who formerly was treasurer. All other officers of the corporation were reelected.

WESTINGHOUSE CHANGES

The appointment of Henry B. Ahlers as assistant to John K. Hodnette, vice president and general manager of the Industrial Products Divisions of the Westinghouse Electric Corporation, has been announced. Mr. Ahlers will be located in Pittsburgh, Pa.

R. F. Spangler has been named field service supervisor for the Pacific Coast, Seattle division of Westinghouse. He replaces W. F. Schanz of Seattle, who has moved to San Francisco as assistant to service manager of the division.

INTERNATIONAL REGISTER APPOINTMENTS

E. J. Bohnen, formerly sales manager, has been appointed vice president in charge of sales of the International Register Company, Chicago, Ill. H. H. Rosenheim has been promoted to assistant sales manager.

In addition to the above appointments, R. Bedford and R. Clark have been added to the sales staff as field representatives.

Two additional electrical division sales offices have been established by Wagner Electric Corporation of St. Louis. The New Orleans office, a sub-branch of St. Louis sales under the direction of N. G. Alvis, is located at 227 Inter-



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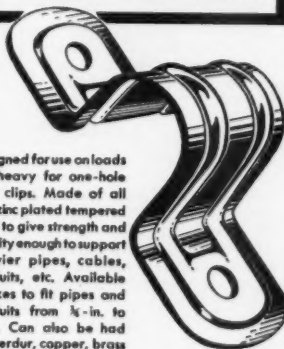
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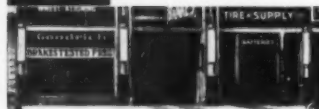
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national Trade Mart. The Davenport office, located in the Kahl Building, is under the direction of S. R. Snyder and is a sub-branch of Chicago.

G. W. Morris of the Wagner Omaha sales office retired after 22 years with the company. G. D. Jackson succeeds him as the electrical division representative at Omaha.

Modern Light & Equipment Co., Chicago, Ill. has named Philip DeVau of Milwaukee, Wis. as representative, covering the state of Wisconsin excepting Ashland, Eau Claire and La-Crosse. He will also cover the Upper Michigan Peninsula.

C. F. Buschagen will cover the state of Michigan excepting Upper Michigan Peninsula.

D. W. Onan & Sons Inc., Minneapolis, Minn. has announced the appointment of Howard Dahl of Sea Bright, N. J. as direct factory sales representative covering the New England states and New York. He will make his headquarters in Sea Bright, N. J.

Bishop Gutta Percha Co., New York City, has changed its name to **Bishop Mfg. Corp.** Charles L. Wiley, who has been in sales and promotion work for 25 years, has been named vice president in charge of sales.

The following sales agents have been appointed: E. J. Planert Co., St. Louis, Mo.; W. E. Wallace, Oakland, Calif.; and Electrical Distributors Co., Philadelphia, Pa.

Irvington Varnish & Insulator Company, Irvington, N. J. has announced the appointment of Donald H. Jones as general sales manager of its coating and fibron divisions. He was formerly sales manager of the American Transformer Company.

Cannon Electric Development Company, Los Angeles, Calif. has announced the appointment of Roger Bowen, formerly with the U. S. Signal Corps, as the new head of the company's engineering department. D. Frank Jackson, who has been acting chief engineer, will continue in the engineering department as chief assistant to Mr. Bowen.

General Controls, Glendale, Calif. has opened a branch office at 721 South Orange Ave., Newark, N. J. William Buck, formerly sales engineer for the company's Philadelphia branch, has been named as Newark Branch manager.

James A. Brown has been appointed general service manager for the **Westinghouse Electric Supply Company,** executive headquarters, New York City, succeeding the late J. A. Vassar.

Cutler-Hammer, Inc. of Milwaukee, Wis. has opened a new sales office at 410 West First Street, Dayton, Ohio. P. L. Erickson has been named manager of the office, which operates as a branch of the Cincinnati district office.

American Transformer Company, Newark, N. J. has announced the inauguration of a distributor sales program and the appointment of Charles L. Davis as manager of distributor sales.

Pinckney B. Reed has been named manager of the industrial equipment section of the **RCA Engineering Products Department,** Camden, N. J. He replaces George L. McKenna, whose promotion to assistant to W. W. Watts, vice president, was recently announced.

Federal Electric Products Company has opened a new West Coast plant at 2885 East Washington Blvd., Los Angeles, Calif.

Advance Electric & Relay Co. has moved into new headquarters at 2435 No. Naomi St., Burbank, Calif.

Diehl Manufacturing Company of Somerville, N. J. has opened a district office and warehouse in the new Singer Building, Detroit, Mich. This office is under the management of James E. Ryan.

Paul W. Hill has been recently added to the research and development department of the **Solar Electric Corporation** of Warren, Pa.

The appointment of Larry J. Brennan as sales manager of the Carry-All Truck Body Division of **Morrison Steel Products, Inc.,** Buffalo, has been announced.

Black & Decker Mfg. Co., Towson Md. has opened a service station and sales office at 1640 N. W. Johnson St., Portland, Ore.

NEW TOWER INSTALLATION TECHNIQUE

[FROM PAGE 56]

each tower, to one 50 kva and to two 37½-kva Pyranol transformers spaced equally around the stadium for the general interior lighting. The secondary distribution is 3-wire, 120/240 v. In addition to the 100 kva transformer, two 36-circuit weatherproof lighting panels are located at the 120-foot level of each tower, each floodlight being protected by a 20-amp. circuit breaker.

All 324 main tower lights are turned on by means of an electrically operated oil circuit breaker, controlled either at the control room or at the service room. At the control room, separate controls operate the parking, seating, existing interior and additional interior lights, through magnetic switches located at the three main lighting panels, adjacent to the Pyranol transformers.

The project for the Park Commission was designed and the installation supervised by Thomas G. Bristow and W. C. Eggert, electrical engineers with the Public Utilities Commission, Bureau of Light, Heat and Power, City of San Francisco, under the direction of B. A. Devine, manager and chief engineer of the Bureau. Spitzer and Washington designed the tower foundations and Dr. J. J. Polivka, Berkeley, was the consulting engineer for the solidification of the sand. The general contractor for the installation of the entire project was the Pacific Electrical & Mechanical Co.



CLAUDE DIETZ, owner of *Diets Electric Company*, Dallas, Texas motor repair shop, adds his 29 years of motor repair experience to the 46 years his father has been in the electrical repair business in Dallas.

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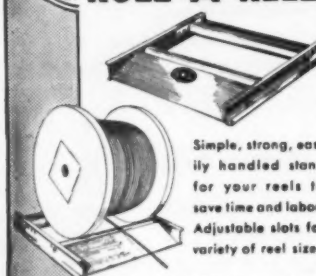
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CARE OF INDUSTRIAL TUBES

(FROM PAGE 67)

age may be reduced until there is a sharp increase in plate temperature. The filament voltage should then be increased until the plate assumes its normal operating temperature. Sufficient allowance must be made for normal line voltage variations.

Standby Operation

Recommended filament voltages of various types of cathodes for standby operation are shown in Figure I. Whenever a pure tungsten filament tube does not have other electrode voltages applied, and if the filament is energized to normal operating temperature the emission life is being used up a trifle faster than when other voltages are applied. Removal of the electrons emitted by application of other electrode voltages cools the filament slightly, therefore, for periods when the tube is not fully energized, that is, for stand-by operation it is desirable to use the stand-by operation table as a guide to obtain maximum life.

Turning the filament on-and-off frequently should be avoided as this may result in its fracture.

Grids

The role of the grid is to establish the potential at a point in space (between the cathode and anode) at the time desired by the tube designer. In a triode, tetrode or pentode the control grid must establish the proper potential to interrupt and initiate electron flow not in a split second but in a split millionth of a second at the higher frequencies. The grid wires and supports are designed to carry the current caused by electrons striking the grid and the capacity currents between the grid and other electrodes.

The tube manufacturer gives a maximum value of negative grid bias, maximum rectified grid current (and usually the maximum value of grid voltage swing).

Where the loading conditions vary widely automatic grid current overload and no-current relays are often desirable to prevent tube damage.

Anodes

The anode has two functions with its primary duty being the collection of electrons passed through the grids in the proper phase relation to deliver radio frequency energy to the tuned plate circuit. The secondary function is the dissipation of the energy released at the anode surface by the impinging electrons.

Radiation-Cooled Anodes

Various materials are used for anodes in the radiation cooled types.

These materials are, in a decreasing order of their ability to dissipate energy graphite, tantalum, molybdenum and nickel. The energy dissipating ability of each is usually increased by roughening the surface by sandblasting or other means.

For a given anode dissipation per unit area graphite has the lowest operating temperature. The other materials must operate at a higher temperature to radiate the same energy. Adequate cooling must be provided for all radiating anode types irrespective of their normal operating temperatures. Where required, air blasts should start with application of filament voltage and may usually be stopped with removal of all voltages unless otherwise specified. Any air blast should be free of water or other foreign material. The manufacturer's data should be consulted for recommendations. It is desirable to use an air-vane-operated switch to remove voltages should the air supply fail. The JETEC data or that of the manufacturer should be consulted for maximum operating temperature of glass envelope.

Water-Cooled Anodes

The proper functioning of a water-cooled anode depends upon a thin wall of water moving at high velocity along the anode surface. This water wall is usually from $\frac{1}{8}$ " to $\frac{1}{4}$ " thick and must travel relatively high velocity to assure turbulence with its resultant higher cooling efficiency and ability to remove steam bubbles from the anode surface as rapidly as formed. It is good tube insurance to use a protective device on the water supply which will remove all electrode voltages if: 1) the water temperature exceeds 70° C; 2) if the water pressure is too low; or 3) if the outlet is blocked.

Where water-cooled tubes are operated in a locality with high mineral content (or "hard") water supply the tubes should be removed and examined often. The removal of scale deposited on the anode is important as such scale reduces the ability of the anode to dissipate heat and may result in damage to the tube.

Water pressure in excess of 80 pounds per square inch should not be used (and water hammer must be prevented). Water hammer can cause anode collapse or fracturing of insulating fittings or both.

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types get little cooling from the water. It is usually necessary to use an air blast to cool the bulb, filament and grid seals. The manufacturer specifies the quantity of air required and its point of application.

Forced-Air-Cooled Anodes

The forced-air-cooled types are usually made by soldering a radiator to the anode of water cooled tubes. Tin, cadmium and some lead-silver alloys are used as solders. Cooling efficiency is primarily a function of air velocity, area, thickness and composition of the fins. The air flow from the radiator is usually sufficient to keep the glass envelope and other seals at a safe temperature. Some forced air cooled types require air blasts at specified parts of the bulb as the tube shape directs the radiator air blast from areas that require cooling.

The plate operates at a relatively high potential, thus dust particles collect on the radiator due to a precipitation action. The high air velocities create electrostatic charges, which also tend to cause dust particles to collect on the radiator. Regular cleaning periods for the radiator and any air filters should be established to assure against clogging with resultant overheating of the tube. In plants where the dust level is high, cleaning periods must be more closely spaced.



Tube Operation and Care— General

Mechanical

Upon receipt of a new vacuum tube of any type it should be carefully examined for any defect attributable to transportation. If the tube is received on a very cold day it should be left in its carton for at least one-half hour after being moved to a warm room to prevent possible breakage from a rapid temperature change. Large type tubes, not packed in cartons, may be protected against sudden temperature changes by covering the glass portions prior to bringing into a warm room. All types should be carefully unpacked or uncrated to prevent subjecting the tube to jars, strains or stresses. Most tubes have some residual glass strain remaining with the possibility of glass failure or implosion. It is advisable to handle new tubes, particularly the larger sizes during unpacking, with heavy gloves to protect the hands. Large size tubes should always be handled by the anode and the forced air cooled radiator types must be handled by the radiator. Tubes, where copper glass seals are used, must not be handled at the copper-to-glass seal. The copper thickness at the seal is

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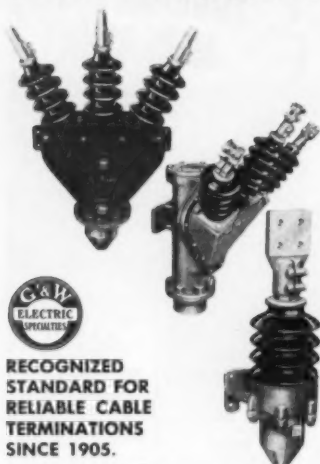
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usually 0.003" to 0.005" thick and is easily deformed.

Before attempting to test the tube all foreign material should be carefully removed. An air blast is desirable for this purpose. The radiator openings of the forced-air cooled types should be examined to make sure there are no obstructions.

When installing in the operating or test position, make sure that all electrical connections are firm and that the tube is not mechanically stressed in any way. Flexible connections *must* be used to all terminals except the one supporting the tube. The water cooled types should be carefully clamped into the jacket before making any connections. It is desirable to use a water solution of graphite on the gaskets to prevent sticking.

Electrical

The time delay necessary before application of plate voltage after lighting the filament is a function of the rapidity with which the filament reaches operating temperature. The smaller types often permit simultaneous application of filament plate and grid voltages.

Precautions should be taken to prevent serious overloading in the plate circuit and its resultant overheating of the tube. Circuit opening devices should be used to open the power circuit in not more than 1/6th second for the larger tubes and 1/4 second in the smaller size tubes. Such overload devices should be in the ground lead and should open the main a-c power source.

Manufacturers of high power tubes usually require the use of resistors or reactors in series with the plate supply for high power installations to limit the overload current until the overload breaker opens the circuit in order to minimize damage to the tube.

In all classes of service, circuit elements or other wiring should be kept as far as possible from glass portions of vacuum tubes to minimize the possibility of punctures.

The high voltages used with power tubes usually results in dust accumulating on the tubes and associated equipment. Dust should be removed periodically, particularly from the glass surfaces, to avoid external flash arcs. Such arcs may seriously damage or destroy the tube. The radiators of forced-air-cooled types are particularly susceptible to clogging from airborne particles. Care must be taken to prevent such accumulations from reducing the air flow. A reduction of air flow will quickly cause overheating of the tube and may destroy or permanently damage it.

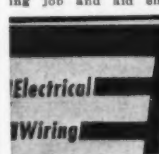
NATIONAL ELECTRICAL CODE HANDBOOK

1. Gives rules and requirements of all jobs; what they mean—how to apply them in accordance with the latest National Electrical Code. All rules for a job are grouped in one place. Covers definitions of Code terms and requirements applying to all wiring systems. By A. L. Abbott. 6th Edit., 633 pages, \$4.00.



ELECTRICAL WIRING SPECIFICATIONS

2. Shows how to draw up wiring plans and specifications that do a better selling job and aid efficient construction. Covers wiring for light, power and signaling—in industrial, commercial, farm and residential buildings. Outlines an orderly procedure for developing specifications. By H. Whitehouse, 181 pages, \$2.75.



Maintenance Manual of ELECTRONIC CONTROL

3. Outlines step-by-step procedure in the installation, routine maintenance and trouble-shooting of electronic control equipment. Covers timing relays, time delay relays, photoelectric relays, etc. Treats instruments and meters; emphasizes cathode ray oscilloscopes. By R. E. Miller, 364 pages, \$4.50.



AMERICAN ELECTRICIANS' HANDBOOK



4. Contains hundreds of detailed descriptions, rules, methods, pictures and practical data to help you install, maintain and operate electrical equipment. Includes recent advances in electronic tubes and circuits and their industrial applications. By T. Croft; revised by C. Carr. 6th Edit. 1734 pages, \$6.00.

See them 10 days—FREE

McGRAW-HILL BOOK CO.
330 W. 42d St., N.Y.C. 18, N. Y.
Send me book(s) corresponding to numbers enclosed below for 10 days' examination on approval. (In 10 days I will remit for book(s) I keep, plus few cents delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

	1	2	3	4
Name.....				
Address.....				
City.....			State.....	
Company.....				
Position.....				

This offer applies to U. S. only

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT:
BUSINESS:

"OPPORTUNITIES"

EQUIPMENT:
USED OR RESALE

UNDISPLAYED

90 cents per line, minimum 4 lines. To figure advance payment count 5 average words as a line. **INDIVIDUAL EMPLOYMENT WANTED** undisplayed advertising rate is one-half of above rate, payable in advance.

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New Advertisements Received by April 14th for the May Issue subject to limitations of space available.

RATES

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The advertising rate is \$9.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An Advertising inch is measured 1/4" vertically on one column, 3 columns—34 inches—on a page. E.C.M.

FOR SALE

2-100 KW 250 volt DC Generators. Steam driven by Ball Engines—140# pressure.

1-200 KW 250 volt DC Generator. Steam driven by Ball Engine—140# pressure. Units complete with DC switchboard and two balancer sets.

1-20 ton York Vertical Ammonia Compressor. Steam driven by Corliss Engine—140# pressure.

1-15 ton York Vertical Ammonia Compressor. V belt drive. 33 H.P.—DC motor. Complete with condenser, receiver, valves, gauges, etc.

150-DC motors—various sizes.

PURITY BAKERIES

97 E. 12th St. St. Paul 1, Minn.

ELECTRICAL CABLE

- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2664 N. Clybourn Ave. Chicago 14, Ill.

MOTORS, GENERATORS, TRANSFORMERS

1-1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N.Y.

WATTHOUR METERS

Large Stock - Reconditioned - Guaranteed Single-Phase, Polyphase and DC—Write for Bulletin.

MASPENOCK ELECTRIC LIGHT CO.
44 Starr Lane Jamaica Plain, Mass.

WANTED

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short
Telephone: Eastgate 7-4778
PIERCE CABLE CO.
2664 Clybourn Ave., Chicago 14, Illinois

WANTED COIL SPREADER

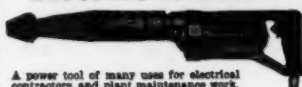
Air Operated
Mfrs. of A.C. generators, lighting plants, and single phase motors
Kato Engineering Co.
Mankato, Minn.

WHERE TO BUY

Equipment, Materials,
Supplies and Services for
Electrical Construction—
Maintenance—Repairs

WODACK "DO-ALL"

ELECTRIC HAMMER



A power tool of many uses for electrical contractors and plant maintenance work. Hammer is detachable from drill motor. Drills concrete 1/2" to 1 1/2" diameter, metal to 1/2" and wood to 1 1/2". Forged hammer tools for chipping, channelling and cutting masonry materials. Attachment for right angle drilling.

Ask for BULLETIN 485-EC

Wodack Electric Tool Corp.
4627 W. Huron St. Chicago 44, Ill.

MATERIALS-METHODS

Materials & Methods engineers in America's leading manufacturing plants use Toplight's Printed Cellophane, Self-Adhesive Tape to meet A-N specs. - assembly line - follow through - instruction labels. Easy to Apply.

TOPLIGHT TAPE CO. YORK PA

THE
Jacques
"JL" SHEAR



This light-weight steel frame cutter is a bear for punishment. Many advantages of larger, heavy duty machines. 40" balanced blade. Rigid, easy setting receiver gauge.

Write for Descriptive Literature.



HOBBS MANUFACTURING CO.
EST. 1882
32 Salisbury St., Worcester, Mass.

A GOOD Habit

The Where-to-Buy Section of Electrical Construction and Maintenance supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue—a good habit!

SELLING OPPORTUNITY OFFERED

SALES REPRESENTATIVE WANTED. Aggressive individual well acquainted with wholesalers to sell a line of Thin Wall Conduit Fittings to jobbers. Prices are competitive and quality is top. Several territories available. Attractive commission arrangement. Write Condomatic Co., 8642 Gratiot Ave., Detroit 13, Mich.

BOOKS

ELECTRICAL CONTRACTORS ESTIMATING HANDBOOK

"A Unique Tool of the Trade"

WRITE FOR DESCRIPTIVE FOLIO TO
THE ESTIMATOR PUBLISHING CO.
1805-B 60th St. Kenosha, Wis.

for Quick ANSWERS

to business problems, use
the Searchlight Sections of:

American Machinist	Engineering News-Record
Aviation Week	E. & M. J. Markets
Business Week	Factory Mgt. & Maintenance
Bus Transportation	Fleet Owner
Chemical Engineering	Food Industries
Coal Age	Nucleonics
Construction Methods	Operating Engineer
Electrical Construction & Maintenance	Power
Electrical Merch.	Product Engineering
Electrical World	Textile World
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McGraw-Hill Publishing Co.,

New York 18, N. Y.

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"Ad-On" MULTI-BREAKER

TYPE MO-8 SERVICE AND LOAD CENTER

ADD CIRCUITS
*Easily, Quickly
At Low Cost*



START WITH 4:

Basic circuit breaker unit provides 4 single pole, 1 double pole and 2 single pole, or 2 double pole circuits in combinations of 15, 20, 30, 40 or 50 ampere ratings.

ADD 4 MORE:

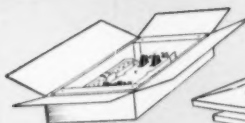
1, 2, 3, or 4 single pole circuit breaker units rated 15, 20 or 30 amperes are easily plugged in on basic block.

Coilless Thermal Magnetic Multi-breaker

The basic "Ad-On" Multi-breaker unit provides four circuits—the minimum for a modern home. Even more important, it provides for easy addition of circuits *as they are needed*. Four off-the-shelf "Ad-On" breakers extend the range of the basic block in the required circuit pattern.

Architects, builders and contractors all know from experience that many electrical appliances are added after homes have been completed and lived in. With "Ad-On" breakers it's a simple matter to provide these circuits so necessary for better electrical living.

FLEXIBLE MERCHANDISING PLAN



1 - BOX WITH BASIC BLOCK



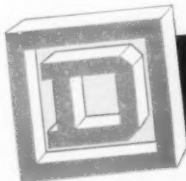
2 - FLUSH OR SURFACE TRIM



3 - "Ad-On" BREAKERS

a Small Stock of COMPONENT PARTS covers all job requirements when assembled in various combinations. Trim and "Ad-On" can be added to basic device carton after selection.

ASK Your Square D Electrical Wholesaler to Show You the "Ad-On"



SQUARE D COMPANY

DETROIT

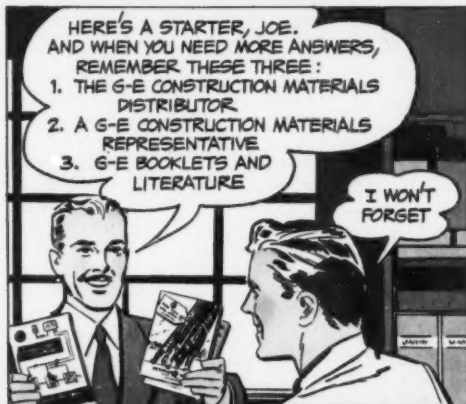
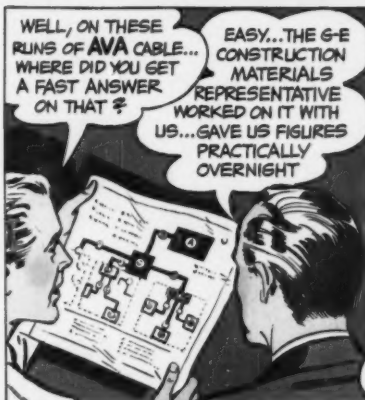
MILWAUKEE

LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

HOW DOES A GUY GET TO KNOW ALL THE ANSWERS?

... THIS FINISHED ESTIMATE WOULD TAKE ME TWO MONTHS



GENERAL  ELECTRIC

Section L3-418
CONSTRUCTION MATERIALS DEPARTMENT
General Electric Company
Bridgeport 2, Connecticut

Please send me information on:

- ☐ G-E remote control wiring
☐ AVA cable
☐ Flexible conduit

☐

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____